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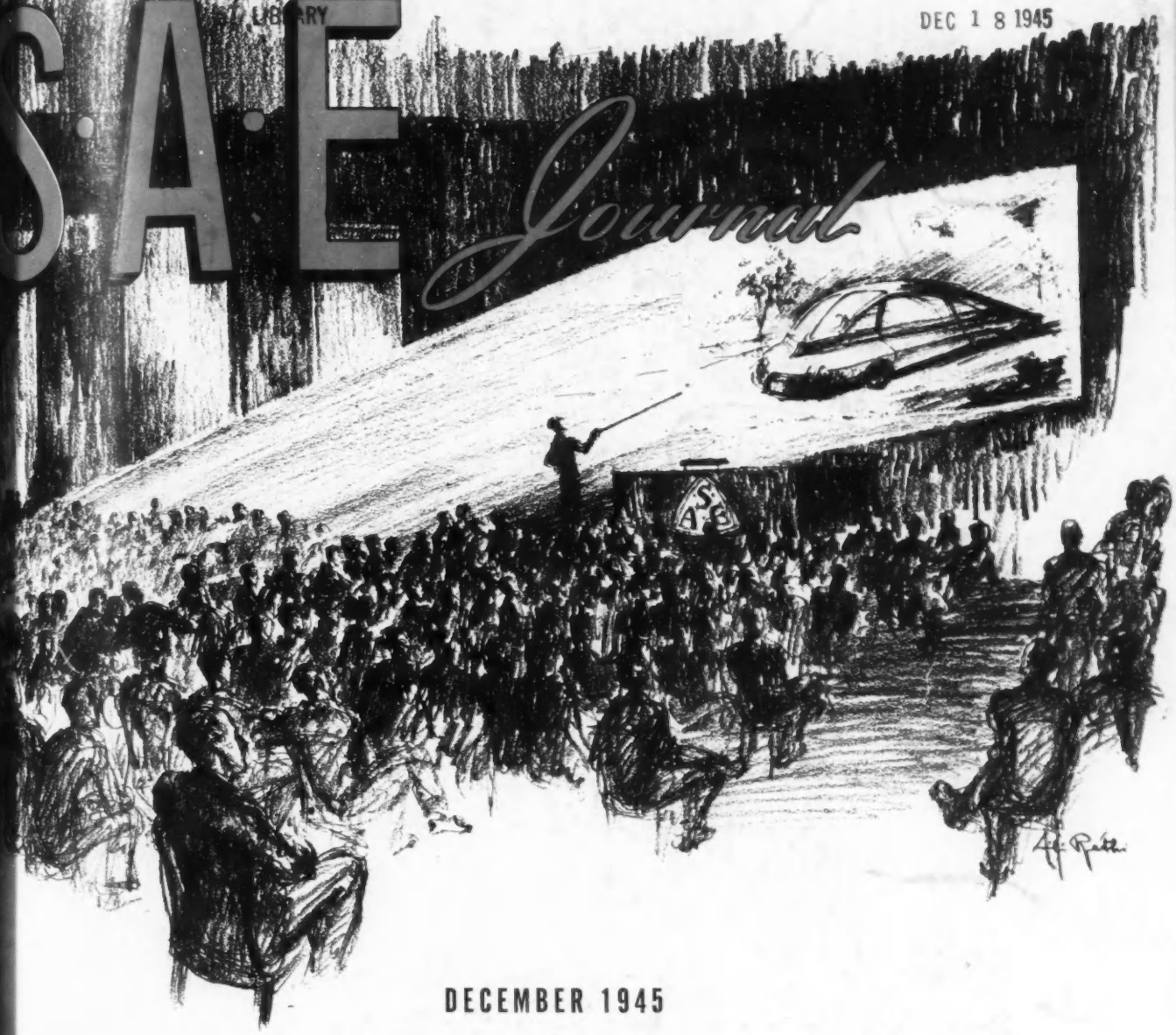

DECEMBER 1945

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SAE JOURNAL *Pre-Prints*

THE SOCIETY OF AUTOMOTIVE ENGINEERS, INC.
29 W. 39TH ST.
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News of the JANUARY *Issue*

By Norman G. Shidle

Stimulate Dissatisfaction

THERE is a little bit of "Tobacco Road" in all of us. The main difference between the derelict on the waterfront and the success in the front office is in standards of dissatisfaction.

That different people get satisfaction in different kinds of achievement is generally recognized. That they may get equal satisfaction in different *levels* of achievement is less frequently grasped. The hobo who chisels a meal without work may get as much satisfaction from his achievement as the executive who gets ulcers with the presidency and can't eat regularly either.

Because industry has a job to get done, it requires men who maintain standards suited to its needs both as regards kind and level. To them it offers myriad opportunities for satisfaction and fulfillment . . . But there never are enough such men – that's where supervision comes in.

Without stimulating supervision of some kind, the "Tobacco Road" in us crops out sooner or later. Left entirely alone, our standards of personal dissatisfaction deteriorate. We tend to become satisfied with less and less. Supervision's most important function is to keep high the standards of personal dissatisfaction among those under supervision. That means stimulating men to high performance because only such performance satisfies their own standards – which is quite different from demanding high performance simply to meet the requirements of the supervisor or the company.

The supervisor who is successful in maintaining high standards of dissatisfaction among those reporting to him has little other supervising to do.

Convert Techniques of Cargo Pickup and Glider-Snatching to Industrial Service

PROMISING heritage of the late unlamented war is the technique of making cargo pickups and snatching passenger gliders as part of the routine of air transport operations.

The technique was developed to something of the proportions of a science during the war. So far the military has had the greater experience in operating personnel-laden gliders. Cargo pickups are in use on air-mail routes.

Multiple Handicaps

Apparently there are psychological, physical, mechanical, and other problems to be solved before such operations become routine in America. As Arthur B. Schultz, of All American Aviation, Inc., will report in January *SAE Journal*, little is known of the possible reactions of potential glider passengers to the business of "snatching." Evidently there's something about the suspense, the dramatically sudden changes from inertia to motion and from landborne to airborne status, which some may be unable to take in stride.

Cargo pickup, Mr. Schultz will explain, is something else. The cargo has no capacity for indignation. The technique promises to become helpful to industry, particularly by providing fast transportation service for isolated operations, such as mining. In fact, there is talk of utilizing cargo pickups to open new areas and new industrial developments heretofore considered impracticable for reason of inaccessibility.

Experience Is Satisfactory

Airmail experience appears to support such plans, however tentative. A 90% average of completed airmail pickups during a five-year period of flying the fickle summer and winter weather of the Alleghenies is cited as being on the convincing side.

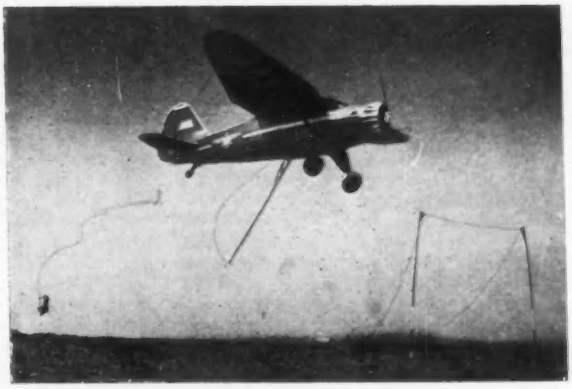
The business of picking up cargoes by plane apparently entered the conception stage about 1913 and became an experimental operation around 1938. Glider-snatching was an immediate prewar development grasped by a military which foresaw good possibilities for moving troops, making rescues, and undertaking other time-saving operations.

As a matter of fact, time-saving is the basic reason for picking up cargoes and snatching gliders on the wing. Theory is that, on airways as well as railways, through operation without full stops makes for speed, economy, and service.

Reel and Rope

Mechanical heart of the pickup and snatching technique, Mr. Schultz will explain, is the energy absorption unit which establishes connection between plane and cargo or between the tug and tow planes. Additionally, the unit accelerates the connecting line to aircraft speed, brakes the payout of the line so as to impose accelerating force as gently as possible upon cargo or glider, and, finally, either rolls the cargo into the plane or adjusts the towed plane to proper flying distance.

Experiments with hydraulic pistons and motors and with several types of brakes and reels led eventually to evolution of the present combination of electrically operated drum and nylon rope, Mr. Schultz will say. Experiments also developed such inescapable facts as that both force and time are re-



Shown here is pickup plane delivering incoming mail container, just before contacting station to pick up outgoing mail – pickup and delivery both being accomplished in a matter of seconds

quired to accelerate a mass to high speed. In the case of air pickup, this must be accomplished in less than one-tenth of a second.

In one-tenth of a second a plane flying 120 mph moves 17.6 ft. Only an elastic rope such as nylon has the necessary stretch and strength.

Mr. Schultz will report that, in actual operations, there are many other engineering problems. Among such to be considered in detail are those of design details of tug planes.

Fuel Injection Promises Aircraft Engine Economy

CURRENT engineering controversy worth watching revolves around attempts to parlay a water, alcohol, and engine combination into an aircraft propulsive unit which will exert something of an explosive effect upon economics, operations, and maintenance of commercial planes.

Basic and appealing facets of the idea are the possibilities of reducing fuel consumption, increasing power output, and eliminating detonation. The business of jelling the idea to the point of practical use has been going on intermittently nearly for a half-century. Application still is handicapped by lack of proof and of knowledge as to the best methods of injecting water and alcohol, what proportions of each to use, and other technicalities.

Small Engines and Big Performance

Controversy currently is inclined to accept as fact that injection really does exert marvelous influences upon engines and fuels. Even discounting the statements of the enthusiasts, water-alcohol injection evidently peps up gasoline by stepping up octane numbers a dozen or so digits. Taking into account the natural pessimism of the reactionaries, injection engines appear to produce tremendous power at crucial moments, such as take-offs. There are those who say water-alcohol injection expands the volume of fuel up to 40% by weight, which should alert those who for lo these many years have been attempting to put gasoline engines on water diets.

When consideration is given to the actual process of injection, differences of opinion are loud, vociferous, and as highly conflicting as the design details and claims for the various and complicated injection systems now available. Emergency war use of the injection principle has tended to accelerate engineering developments. The military couldn't wait for the controversy to clear; it just went ahead and injected with results which pleased nearly all except the enemy.

Antidetonation and Cooling

By approaching the whole subject from the angle of cooling effects, M. R. Rowe and G. T. Ladd, of Wright Aeronautical Corp., will present in January *SAE Journal* a reasoned, documented, scientific exposition of the facts of the case. They will report results of investigations carried on since 1933 as demonstrating that injection of water-methanol combinations effectively inhibits detonation and promotes internal cooling of aircraft powerplants.

They will disclose such findings as:

- Water alone offers the best rate of engine cooling.
- Water-methanol permits the greatest power output.
- Water-methanol affords the most effective antidetonant.
- Water is as effective as fuel when used as an engine internal coolant at high power output.
- Water injection will permit the use of 87-91 octane fuels in place of 100 octane for equivalent power output up to take-off horsepower.

These and other findings will be shown to bear directly upon and to afford benefits for commercial airline operations. The authors will say that fuel savings at high power output are on the order of 25%. Approximately 1000 to 2000 ft of engine critical altitude can be gained at take-off power, they will report, by using water cooling instead of fuel cooling. This advantage is described as meriting consideration by operators using airports differing in altitudes or whose operations demand close watch upon all possibilities for increasing payloads.

It will be explained also that, during World War II, aircraft-engine development has been along the lines of increasing brake horsepower output per cubic inch of displacement. Result is that the commercial operator must meet the higher costs of fuels above the customary 87-91 octane range, accept lower power output—or turn to water-alcohol injection.

The Cover

Every SAE meeting is different—in the people you meet, the discussion you hear, the information you acquire. . . . Yet every SAE meeting is the same—in the opportunity for contacts, the chance to learn something new, the spirit of coordinated attack for the solution of common problems. In recent years attendance at SAE National and Section meetings has usually exceeded thirty thousand.

This month's cover was drawn from life by Artist Lili Rethi at one of 1945's most important SAE gatherings.

Add Heat Treatment To Production Line

MODERN trends are toward utilizing induction heat-treating equipment as machine tool installations. Occupying limited space and operating at high speed, this equipment contributes to expanded production and reduced manufacturing costs, simultaneously improving product quality.

So F. F. Vaughn, of Caterpillar Tractor Co., will report in January *SAE Journal* in an article describing actual plant experience with heat-treating as one step in production, the equipment used as a machine tool. He will say that the method is satisfactory both for surface and through hardening and, being automatic and precisely controlled, assures uniformity of results.

Mr. Vaughn will list among the attributes of this old but newly recognized industrial tool its helpful simplicity and adaptability. He will report that it eliminates or minimizes such multiple, time-consuming steps as cleaning, straightening, decarburizing, and handling.

For instance, Mr. Vaughn will explain, 1-in. bars progressively can be through-hardened while moving at the rate of 22 in. per min. Once the equipment is installed, heat-treatments may be applied when and as desired to crankshafts, track link pins, axle shafts, pump shafts, gears, cylinder liners, and other parts.

Some parts are heat-treated in the rough or rough-finished state to increase overall toughness and strength, then are given a final heat-treatment in the finished state to prolong service life.

Models Facilitate Engineering Tests

THE ancient art of model building, once practiced in furtherance of religious beliefs, has been revived by industry for purposes of making estimates of stresses and strains with an accuracy of close to 5%.

Particularly in cases of pretesting heavier- and lighter-than-air craft is the model convenient, accommodating, economical. Accurately scaled down, it can be designed, constructed, and tested at a fraction of the expense of the full-scale jobs, yet is astoundingly revealing of engineering pitfalls and dangers.

O. W. Loudenslager, of Goodyear Aircraft Corp., will tell in January *SAE Journal* how models satisfactorily are used to pretest rigid airships, and how increasing attention is being paid to producing models of structures, presently of girders, eventually of other units subject to stress and strain.

Goodyear engineers, Mr. Loudenslager will say, have developed unique and precise stress model designs productive of results in excellent agreement with expectations calculated from theory.

Similarity

Precise results will be said to demand close observance of relationships between the scales of dimensions, forces, unit linear deformations, and angular displacements. The model must be geometrically similar to the prototype both before and after loading. In fact, observance of the rule of similarity, for which Mr. Loudenslager will present comprehensive formulas, appears to be the first law.

Metals and plastics are used in model construction. Metals such as hard-drawn or spring-tempered yellow brass are preferred. They resist corrosion, have low modulus of elasticity, are easy to machine, and readily accept solder. The photoelastic properties of plastics make these materials suitable for some models, but results are likely to be adversely affected by aging, temperature, humidity, and creeping tendencies under load.

Testing methods are of two general types: indirect, with stresses obtained from influence lines, and direct, in which scaled-down loads are applied. Model designs for the two types of test fundamentally are the same. Both correctly must represent the stiffness of the prototype.

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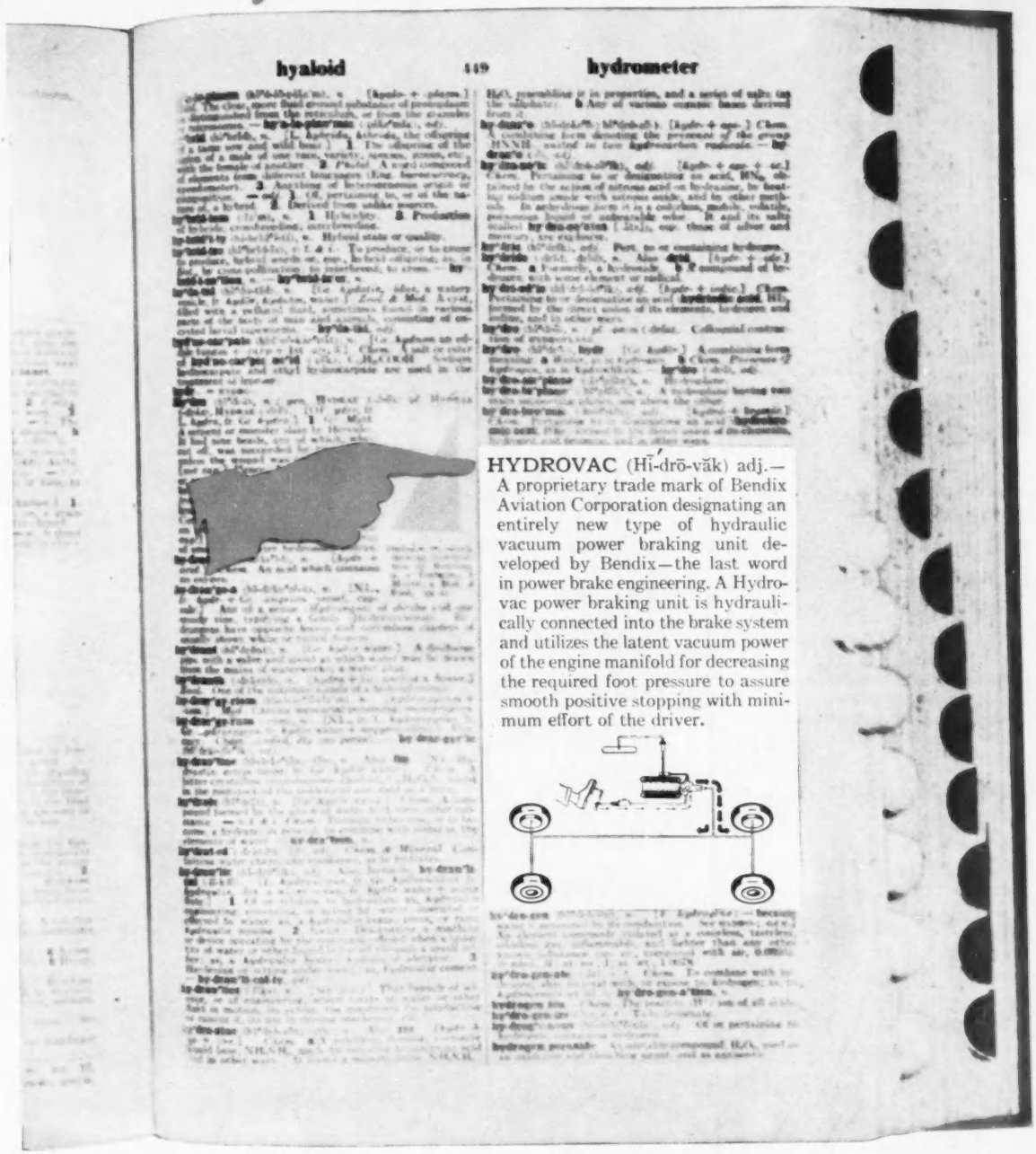
DECEMBER 1945

It's not in the Dictionary . . . but

it is *a New Definition* for the Best in Power Braking



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CARS and Men of Old and Their Challenge to You

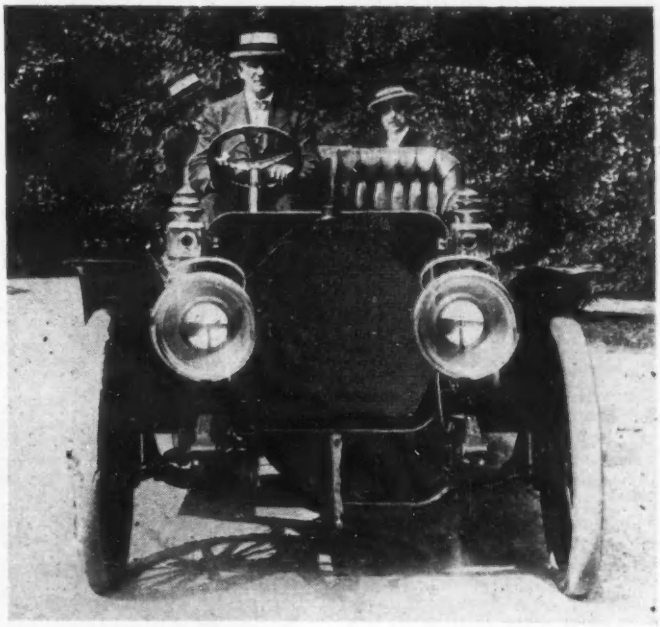
By F. E. Moskovics
A. O. Smith Corp.

addressing you on the good old cars of the past, I cannot divorce my memories from the men who made those cars. They re a colorful lot and many of them made contributions far greater an has been indicated by the scant credit they will ever receive. bear with me while we travel back to the early days of this dustry. As this is a commemoration of the 50th anniversary of e first automobile race in America, it may be well to call attention the fact that many of those pioneer builders and designers were o the drivers of their contest cars and racing and endurance con- ts went hand in hand with the development of the early auto- bile. The fact is that these early races and contests were the erunners of the huge laboratories and experimental engineering partments of the present day. Actually, they were the only experi- ental departments we had in those days.

Notable illustrations of these early race driverss were Henry d who drove his famous 999; Charles Schmidt, the designer of early Packard; Alexander Winton, designer of the famous Winton s; Edgar Apperson who drove the early Apperson, and, of course, J. Frank Duryea, whose victory of 50 rs ago we now are here commemorating. This, of course, emphasizes the fact that se early pioneers were young men and experience these men gained in those contests went a long way toward guid- and dominating the early designs and, n after they retired from racing and nger men took their places, they kept a y close eye on the performance of their ing cars. I can best illustrate the im- rance of racing on the early automobile dustry by the story of a conversation be- en Henry Ford and Barney Oldfield, r Barney took over the famous 999. rney said to Mr. Ford one day, "Henry, u know, I made you. The fame and putation you got from my racing the 999 de the Ford company more than any- ng else" and Mr. Ford turned to him d said, "Well, Barney, don't forget if u made my company and my reputation, lso made you." To which Barney re- ed, "Well, Henry, all I can say, if you de me and I made you, I did a better than you did."

For the sake of definition, let us take the r 1902 as a starting point. Of course re were some tortuous years before that e, but I am taking that year as a work- point because by then we had a budding omobile industry which had real vigor d vitality. In those days the American omobile industry was taking definite pat- ns. We had, of course, the controversy gasoline, steam, and electric powerplants. us not minimize the vigor and acrimo- usness between the proponents of those ferent prime movers. Although the steam had attained considerable prominence racing – as exemplified by the famous

This paper was presented at the SAE Chi- o Section on Nov. 13.



Just visible in the back seat (left) of this 1907 Allen-Kingston automobile is the author. This was the first car designed by Mr. Moskovics and was being driven by Dave Graham, one of Mr. Moskovics' associates at the time. It was one of the first of the European type of car built in the U. S., and in the following year was driven by Ralph De Palma for a world's record

White "Whistling Billy" and the Stanley Steamer – even the early electric vehicle entered endurance contests. In those early days an electric racing car was built by Walter Baker. That car and the "Whistling Billy" White were perhaps the first streamlined cars ever built, but we can dismiss all but the gasoline cars for the purpose of this discussion.

Around 1902 the American gasoline automotive industry was taking pattern along two rather definite lines. One, the typically American type, and the other, what might be called the European type. Briefly, the American type in those days had horizontal cylinders located somewhere under the body. The majority of them had a single cylinder, but sometimes two cylinders opposed. Naturally they had very heavy flywheels. One of the clearest examples of this type was the early Cadillac and a brief description of this car will answer pretty generally for the type. In addition to the horizontal cylinders located about the center of the chassis under the floorboards, invariably the transmission was planetary, two speeds forward and reverse, and the drive was by single chain to somewhere around the center of the rear axle, which was called the "live axle." The ignition was jump spark with a vibrating coil and dry batteries of six volts. There was a great deal of difference in frame construction. Some had pressed steel, others had tubular steel, some had wooden frames armored with steel, and some merely used angle iron. They were all right-hand steering. Just about this time there was a great deal of argument between automatic and mechanical inlet valves. Bear in mind these early engines all had suction inlet valves. In other words, the valves were opened by the vacuum created by the suction stroke of the piston. This was called automatic. Now, believe me when I say to you, that an expert was the fellow who could adjust these valve springs to the best advantage.

Other cars of this type were the famous Oldsmobile curved dash runabout, the early Packard, the Pope-Hartford, the Rambler, the Knox aircooled and the Northern. A slight deviation from the type was the Autocar and the Columbia. They had their opposed engines located forward under the bonnet. Another prominent type in those days was represented by the Franklin. This had a 4-cyl aircooled engine set crosswise at the front of the car and driven by long chains to the rear. The Marion, made at Indianapolis, was also of this type.

It may be well to call attention here to the contributions of the aircooled development to its logical successor the aircraft engine. This was, in the early days, typically an American development. The foreigner sneered at our "frying pans," our "oilcooled engines," but the proponents of the design never faltered. The Franklin and the Marion were typically aircooled. They were followed about 1904 by Lee Frayer, the designer of the early Frayer-Miller, who so far as I know, was the first man to force air around the cylinders by a blower.

Frayer was a remarkable combination of engineer and mechanic. He was a graduate of Ohio State University and I believe made the early computations of the requirements of air over the cylinders. He used a blower geared from the crankshaft and forced the air around the cylinders from the top down.

turn to p. 42

Correct Assumptions— Keys to Success

Digest of talk
by

WILLIAM B. STOUT
Consolidated Vultee and
Graham-Paige Motors Corp.

▪ Metropolitan, Nov. 1

(Summary of ideas expressed by Mr. Stout in his talk on "Future Design Possibilities.")

CORRECT assumptions, even if worked out by faulty logic, have a chance to succeed, whereas bad assumptions can never achieve success although they be developed by the clearest reasoning.

If automobile design is to be improved radically, the car of the future must be designed from the ground up – not from the roof line and thence downward to the pavement.

Draw a road line, then two wheels, and sketch in a frame. Look at this simple sketch, and decide whether the tractive effort is to be applied on the rear or front wheels. With this decision made, go ahead and design your own car.

To give your new design the best chance to succeed, assume that simplicity is one of the most important of all factors. Perhaps next important is the assumption that performance is more important than style.

One of the false assumptions that should be thrown away at the outset is that streamlining, *per se*, is effective on ground vehicles. It isn't. Streamlining adds nothing to the performance of a motor vehicle, valuable as it is in aircraft design.

A sound assumption is that the future owner of your car wants to be comfortable. He and his family and friends want riding comfort. They want proper ventilating and adequate heating. To be incorporated effectively, these functions should be designed into the basic structure of the car.

Another good assumption is that the vehicle should have enough room built into it to make the driver and his family comfortable. This is quite simple, if we go back and look at the rough sketch and locate the occupants in the most spacious area – which happens to be the most comfortable from the standpoint of a comfortable ride. This is between the front and rear axles.

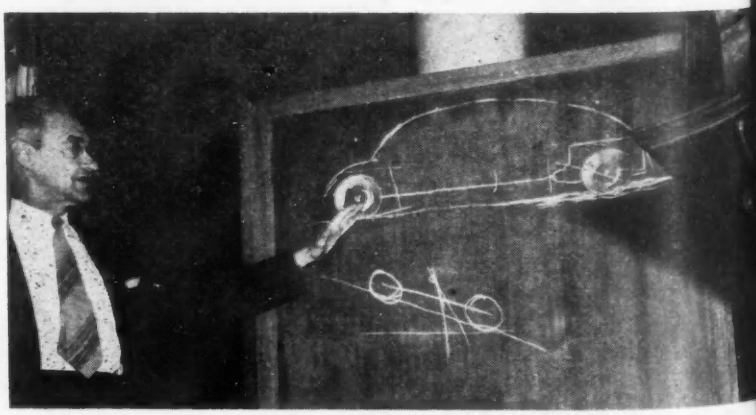
Automotive vehicle designers should constantly keep alert to developments in the aircraft and accessories fields. Some of the best vehicle ideas have come from outside the industry, and these sources are more prolific today than ever before.

The luxury car of tomorrow will be a rear-engined automobile. We will be using new materials in the future. As fabrication techniques improve, new doors of opportunity will be opened to all vehicle designers.

For the past 15 years the automobile designer has been going along his way content with minor changes. The time for serious experiment is at hand, because we are faced with a new economy in which only men with imagination and ingenuity will be able to survive.

Too few men are willing or able to think in fundamental terms. The human mind is prone to copy, and often in doing so, errors in judgment and mistakes in design are perpetuated.

The future for young automotive engineers is brighter now than ever before, if they are willing to assume that the fundamentals of engineering are simple. The doors to new developments and opportunities are opening wider all the time, as we are approaching an era of intensified experimental work on all fronts of automotive engineering by hundreds of companies in every branch of the automotive manufacturing activity.



Past-President Stout illustrates vehicle traction principles

Industry Seeks Technical Vision

Digest of talk
by
HENRY M. CRANE
General Motors Corp.
▪ Metropolitan, Nov. 1

(Summary of ideas presented by Mr. Crane in his talk on "The Modern Motor Car and How It Got That Way.")

SKILL in borrowing *others'* ideas is the mark of the successful engineer.

Down through the 50 years of automotive engineering, as illustrated by photographs and technical descriptions of automobiles that are today only vague names to most motorists, sound basic engineering ideas recur again and again in the evolution of the motor car as we know it today.

Many of these ideas, such as high compression engines, improved spring suspension and better riding comfort, today's styling with multicolored bodies and trim, had to wait until collateral developments in metallurgy, chemistry, and production techniques caught up to the parade of advanced thinking.

The engineer who cannot peer beyond his own specialty will have only an unimportant place in the postwar world. The young engineer who dedicates himself to a thorough understanding of transportation, who can grasp the interrelationships of economics, detail design, and the overall functioning of a vehicle – whether for land, air, or sea travel – has the world before him.

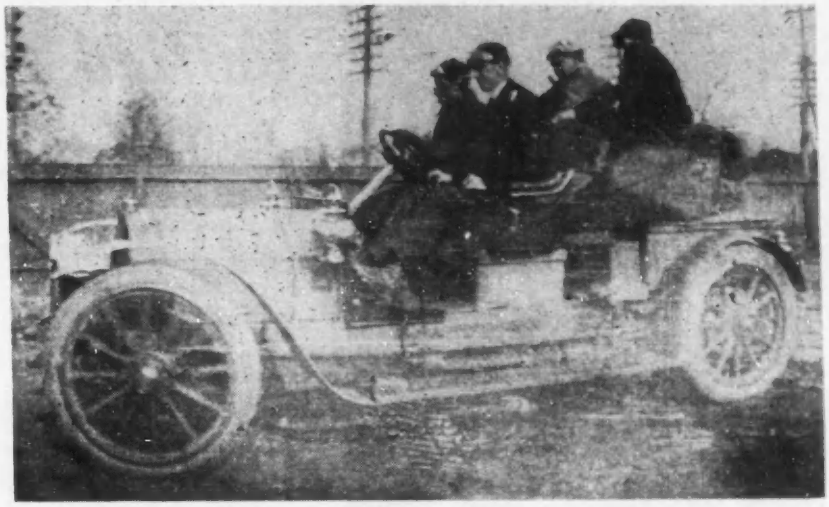
The future is just as bright as the past for the man who can steal good ideas and translate them into a product that will fit into tomorrow's American and world economy.

Gear shift controls were on the steering columns as early as 1904, but they went out of the automotive picture until transmission gears, improved both with respect to design and materials, were available. Thus the motoring public was forced to wait until a good idea could be expressed in a practical mechanism.

From a broader aspect, the Ford 6-cyl motor car was the end of an era, and by 1906, the Ford Model T had started a new epoch in universal transportation. This vehicle had practically no stampings. Most of it could have been built in any good sheet metal shop of that day. Then as metal pressing and stamping techniques caught up with Mr. Ford's ideas, the 1908 Model T reflected these shop practices. By 1926 the Model T had been completely restyled, due to further advances in metal working.

Another approach to styling is clearly shown in the series of Crane-designed cars. They were designed along the lines of today's popular "streamlined" automobiles, but their bodies had to be built by hand. They were, consequently, expensive, but no knowledge existed of body presses and welding techniques which are common today. Racing in a high priced bracket, aluminum body sheets, fenders, transmission cases, crank cases, and rear axle housings were used.

It was not until 1924 that a sweeping adoption of curves in styling was adopted. In that year Walter Chrysler introduced the first model to bear his name, and the public reacted favorably to his idea of overall length as an important sales point – rather than wheel base.



Past-President Crane at the wheel of an early Crane experimental model

It was soon after that that General Motors Corp. inaugurated its styling section. Then we saw the gradual disappearance of the gasoline tank and spare tires.

The all-steel body marked another important advance. Again, we all had to wait until steel pressing, with deep drawing, had been developed. The E. I. du Pont de Nemours chemists had developed the synthetic resin Duco spray paints, and the low-priced car in brilliant hues took the country by storm. The paint job on an early Crane, for example, cost more than a complete Chevrolet of some 20 years later. But until the chemists caught up with the parade, the poor man had to have a black car and only the rich could afford a hand-painted vehicle with its more than 20 coats of filler, color, and finish varnishes. There wouldn't be enough warehouse space in Detroit to handle mass production of a model in color which was applied by hand and had to air dry between rubbings and finishings.

The passenger car is probably the most personal piece of machinery built and sold to the American public. The wide variety of public tastes presents the toughest of all challenges to the motor vehicle engineer. Motor car manufacturers are looking for good ideas, just as they always have been doing. The young engineer who can visualize the completed vehicle as a unit, and who can transcend the details of parts design, has the world at his feet. Such men have never had a greater opportunity for success than today, and men of real ingenuity and understanding of the public's wishes will prove this prediction.

Guiding Compromises Is Role of Engineers

Digest of talk
by
WILLIAM S. JAMES
Ford Motor Co.
▪ Metropolitan, Nov. 1

(Summary of ideas presented by Mr. James in his talk on "Present Day Requirements to be Met by Passenger Car Designers.")

WHETHER the impact of forces upon the vehicle designer is of economics, of production techniques, or of environment, he must guide each compromise in detail toward a vehicle which can be manufactured at the lowest possible cost, which will appeal to the motorist, and which will give satisfaction.

Automotive engineering has been built upon the death of many ideas, in a manner similar to the growth of coral. Many ideas which appeared to have died years ago are again back with us because some manufacturing technique has since been developed to make them practical.

A case in point is the "rediscovery" of shot peening or shot blasting of stressed parts. The village blacksmith exercised great patience in peening leaf springs. All he knew was that this peening gave the leaves longer life. Today, largely through the work of J. O. Almen, General Motors Corp., engineers have a better understanding of this phenomenon, and the equipment manufacturers have given us machinery which has effectively returned this practice in mass production speed of manufacture.

Technical factors are detail design, manu-

SAE Member Lt.-Gen. James H. Doolittle signing autographs at Met Section Meeting

cont'd from preceding page

facturing tools and improved techniques, materials and a better understanding of their mechanical and manufacturing properties and characteristics, and the size of components and the end product. Engineers can do a great deal about these.

Production factors include cost of manufacture, life of the product to some extent, performance, economical operation, and in some degree appearance. Design engineers should know more about these factors.

Environmental influences include wars and consequent economic factors, and the extremely important proposition of popular imagination. Designers can do little about these things, but should understand their impact.

Since the petroleum industry has no "yearly models" in new fuels and lubricants, it behooves every design engineer to know as much about these important elements as possible. There is a vast area of improvement ahead in better matching of engines to the available fuels, and in knowing about the improved characteristics of lubricants in designing bearings.

Thus each of the thousands of component parts of a vehicle represents a compromise. Only factually guided compromises will survive in the competition which brought the automotive industry into being, and which has made it the world's largest manufacturing business.

Proper mixing of the ingredients of automotive engineering is all important, because there are too many well-designed vehicles on the roads today and on drawing boards to permit the financial success of second-raters. The more an engineer knows about each of the factors of design, production, and environment, the better able will he be to make the compromises which will add up to a successful model.

Unified Top Command Asked to Secure Peace

Digest of Paper
by

GEN. CARL SPAATZ

■ Metropolitan, Oct. 11

TRANSITION to the atomic age finds Americans psychologically unprepared, according to General Spaatz. Our impressive record in military achievement, production, and training of personnel has bred in us a feeling of pride and faith out of proportion to our present ability to deal with future wars or threats of war. Complacency and confusion, General Spaatz believes, can be deadly in this transitional period.

In framing future policy, he pointed out, we have concrete facts to go by. We know that the combination of air superiority and the teamwork of the three forces was the key to victory in this war; we know that the atomic bomb requires and will require air transportation and control of the airways; and we know that time will not work on our side another time as it has before. We must realize, he warned, that current strength is no index to future security, and that a new weapon is effective only until a deadlier counter-weapon is devised. For these reasons, he feels that there can be no question of the need for developing a strong air force, and for integrating it into a powerful and effective triumverate of land, sea and air power. It is the duty of professional air men, General Spaatz urged, to indicate the dangers ahead, and to help convince the public of the absolute necessity of paying now in time and money for real security in the future. In the final analysis, however, the decision, and the full responsibility, rest in the hands of the American people.

Discussion

In the succeeding discussion period, General Spaatz said that allied strategy had planned the use of buzz-bombs both in Europe and in Asia. "Cockeyed" German strategy, however, eliminated the need for them in the Rhine area, and the Japanese war ended before we had a chance to think of using them, while our Air Forces were still over 1000 miles away. He also pointed out that the terrific expense of an atomic bomb makes it imperative that it reach its target; the two bull's-eyes made in Japan were due solely to our control of the air over Japan. Therefore the possession of the atomic bomb secret does not obviate the necessity for a strong air force. Asked about the probable cost of the proposed plan for defense, General Spaatz said that if all the services are controlled by one agency, and their requirements coordinated with an overall composite picture in mind to avoid duplication and overlapping, the cost can be a small fraction of the cost of war itself.

Digest of Paper
by

GEN. JAMES H. DOOLITTLE

■ Metropolitan, Oct. 11

THE American people are tired of war. This fact represents to General Doolittle one of the best reasons for preparing now to avoid another war. If it cannot be avoided, it must be won quickly and painlessly.

The maintenance of air power superiority, he believes, is of prime importance to a program of preparedness. To give the air force the power and scope it must have, it must be raised to parity with the other branches – politically, administratively, and operationally.

Teamwork enabled us to win this war; lack of teamwork helped the enemy to defeat itself. We cannot win another war without it. But, General Doolittle points out, we must realize that future developments will outmode present weapons. Nor can we base our prophecies on past achievements and past events. Seeing into the future demands more imagination than ever before. We can make certain estimates, Gen. Doolittle believes, based on the present rate of invention. For instance: in the immediate future, we may expect long-range bombers, long-range fighters, and long-range transports, requiring outlying bases only until their range is sufficiently great to enable them to fly to any part of the earth and return. In the near future, we may have planes with a 10,000-mile range. By that time, air power will be the only decisive military factor, because, as the General points out, the North Pole is the key approach to any and all potential enemies. In this period, the Army's job will be one of occupation, and the Navy will be used for carrying supplies if air transport is not feasible. In the distant future, with long-range rockets, gyro-stabilizers, radio-controlled and radar-directed, and controlled atomic power . . . air will still be the medium.

General Doolittle estimates that a seventy-group air force, little larger than his own Eighth Air Force, will be adequate to meet our requirements. This would be small enough not to be an economic burden, yet large enough to impose our will for peace on any agency which wanted to start war.

Because of the growing remoteness and abstractness of methods of making war, there is a need, he feels, for advanced thinkers, for young men with open minds and with the vision to prepare for a future whose outlines are still dim. Concrete plans, he urged, should include a Department of National Defense, with a Secretary for War, or for Defense, and assistant secretaries of equal status for land, sea and air. This administrative set-up should be paralleled operationally by a supreme commander and specialists in land, sea and air heading the three sections under him.

An agency directly under the supreme commander should be charged with the procurement of supplies and another agency would handle the direction of research operations for the development of new weapons. In cooperation with the program, General Doolittle believes, each manufacturer supplying government materials should have an extensive engineering section so that science and industry may anticipate, or at least keep pace with, events.

Above all, the American people must realize what another war will mean, and must back a preparedness program which is our best insurance against another war.

Discussion

General Doolittle gave further emphasis to his plea for preparedness, in answering questions during the discussion period, by suggesting that World War II might never have happened if we had carried out such a program for national defense five years ago. His description of the almost utter destruction of Japan by our superior air power not only was an endorsement of past performances by the air force, but also gave credence to previous warnings of what another war might mean to us if we were caught napping again. In describing advances in air power efficiency and safety during the war, General Doolittle said that by the end of the war, bomb loads of as much as 30,000 lb from Okinawa to Tokio were planned; that by a conservative estimate, one battleship firing for an hour (assuming it remains safe from attack) is equivalent to 3½ B-29's, and that planes very much superior to the B-29 are almost ready for tests.

■ ■

Lubricity Given Due Emphasis by Continuous Oil Maintenance

Digest of Paper
by

WALTER C. BAUER
Briggs Clarifier Co.

■ Washington, Oct. 11

(Paper entitled "Basic Requirements of Lubricating Oil Maintenance")

DESPITE the importance of "lubricity" in lubricants, there is no lubricant available, according to Mr. Bauer, which has this quality 100%, nor is there any standard for the measurement of lubricity, or any approved ASTM method to approximate a comparative value of this quality in different lubricants. Yet lubricating oil is bought and used primarily for its lubricity value. The best possible oil for a given machine is obtained, Mr. Bauer explained, by a process of comparing requirements in viscosity, flash, pour point, and so on, with known qualities of different branded oils. This necessity, added to the fact that tests usually are made on comparatively new machines under nearly ideal conditions, has made it imperative, Mr. Bauer feels, that improvements be made both in the methods of judging oil quality and in the means of maintaining this quality in usage.

Mere filtering for the removal of visible dirt, he said, is not enough, as evidenced by the results of tests made on aviation engines to compare the results of complete clarification every 25 hr, filtering to remove dirt every 25 hr, oil change every 50 hr and mere addition of new oil when needed. The tests showed that ordinary filtering kept oil little cleaner than complete changes every 50 hr, but did have advantages in keeping the oil closer to its original viscosity than the filter method did, and in reducing overall fuel consumption.

The basic requirements for oil maintenance are the same in all cases, Mr. Bauer said – to maintain the oil as near to the new oil specifications as possible, although different equipment may be needed because different types of machinery contaminate the oil differently. Years of research have established limits, physical and chemical, beyond which oil in an internal combustion engine should not be contaminated. Five hundred miles, under near-ideal driving conditions, is possible for a passenger car without changing oil. On most diesel engines the contamination limit would be reached in from 2 to 6 hr. Aviation engines last only about 10 or 15 hr, and it is nearly impossible to change oil completely without dismantling the oil plumbing system.

Drainage and reconditioning of oil for re-use is slightly more economical, but Mr. Bauer maintains that successful continuous oil maintenance requires separate oil maintenance equipment for each machine. He described two quite successful experiments with continuous oil maintenance. The first was conducted in a stationary 300 hp gas engine. After over three years of continuous operation with no change of oil, all rings remained free and carbon was light; by way of comparison, before installation the same machine after 50 days' running time had to have varnish removed from all pistons, all rings removed, pistons and sump cleaned, and five rings replaced.

The second test was made on a diesel-powered ferry run for almost six years with no change of oil. The chart shows that the neutralization number (representing chemical contamination) remained well below the contamination limit of 0.3, and the precipitation number (representing physical contamination) well below the 0.05 limit, above which dirt may be deposited in the oil passages of the machine itself.

Mr. Bauer explained that physical contamination can be removed from the oil by a number of materials ranging from pulverized corn cobs to fine processed filter paper. This process of *absorption* removes particles much smaller than the 10 micron size stipulated in oil maintenance requirements, but presents certain difficulties: the filter area must be great enough to keep the flow rate through the filter below the capillary flow rate of the liquid; depth must be sufficient to accomplish the necessary dirt absorption; the filter must be large enough to accommodate all the dirt generated in the oil over a period of time, and provision against backwash must be made.

Chemical contamination caused by the formation of gums, resins, organic acids and

turn to p. 39

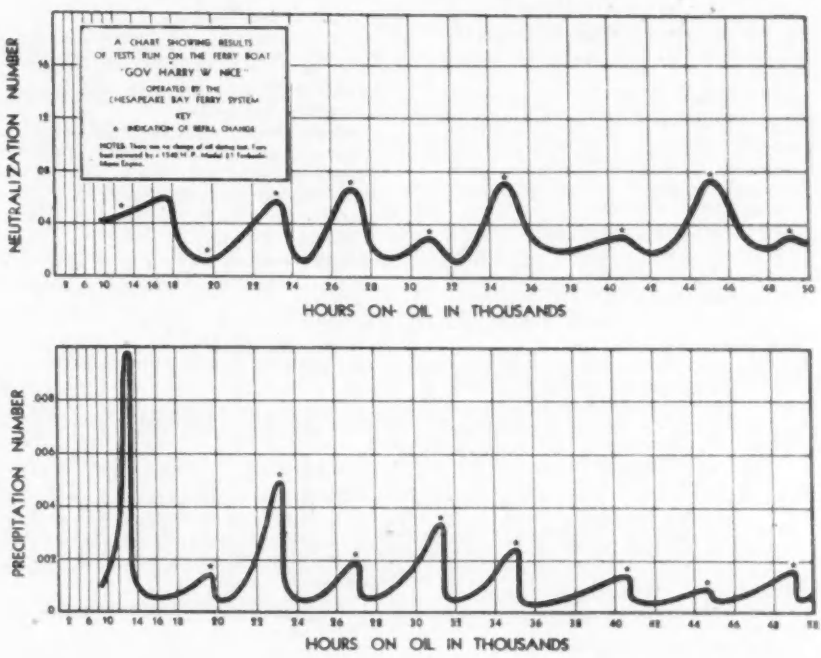


Chart showing effects of continuous oil maintenance on neutralization and precipitation numbers

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JANUARY 7-11

MONDAY, JAN. 7

Morning — Transportation and Maintenance

How Chemistry Simplifies Automotive Cleaning Methods and Procedures
— *Ray Sanders, Turco Products, Inc.*

Morning — Materials

Substitutes for Tin in Automotive Vehicles
— *C. E. Heussner, Chrysler Corp.*
Methods for Specifying Materials
— *J. L. McCloud, Ford Motor Co.*

Afternoon — Truck and Bus

Review of Brake Design and Methods of Rating Brakes for Commercial Automotive Vehicles
— *R. K. Super, Timken-Detroit Axle Co.*
Prepared discussions by:
— *M. C. Horine, Mack Mfg. Corp.*
— *B. E. House, Bendix Products Division, Bendix Aviation Corp.*

Afternoon — Materials

Outlook for Rubber for the Automotive Industry — Synthetic and Natural
— *John Collyer, B. F. Goodrich Co.*
New Synthetic Lubricants
— *J. C. Kratzer, Linde Air Products Co.; D. H. Green, National Carbon Co.; and D. B. Williams, Carbide & Carbon Chemicals Corp.*

Evening — Junior Student

Development of Atomic Energy
— *Dr. John R. Dunning, Physics Department, Columbia University*

TUESDAY, JAN. 8

Morning — Transportation and Maintenance

Symposium — Approaches to Vehicle Retirement
Moderator — W. J. Davidson, General Motors Corp.
G. W. Laurie, Atlantic Refining Co.
W. A. Taussig, Burlington Transit Co.
H. L. Willett, Jr., Willett Co.
D. K. Wilson, N. Y. Power & Light Corp.

Morning — Passenger Car Body

The Driver's Comfort
— *O. F. Quartullo, Visioneering Co., Inc.*

Buffet Luncheon 12:30

Afternoon — Truck and Bus

Motor Trucks of the Future
— *Robert Cass, White Motor Co.*
Motor Coaches of the Future
— *L. H. Smith, General American Aerocoach Co.*
Highways of the Future
— *H. S. Fairbank, Federal Works Agency, Public Roads Administration*

Business Session 8 p.m.

Evening — Passenger Car Body

An Aircraft Approach to Automobile Body Design
— *Mac Short, Lockheed Aircraft Corp., and W. E. Miller, Consulting Engineer*
What Motor Cars Could Be
— *W. B. Stout, Graham-Paige Motors Corp.*
Body Standards Report
— *E. C. DeSmet, Willys-Overland Motors, Inc.*
Education Project Report
— *Prof. W. E. Lay, University of Michigan*

WEDNESDAY, JAN. 9

Morning — Passenger Car

Fundamentals of Suspension
— *H. E. Churchill, M. Z. Delp, and P. G. Hykes, Studebaker Corp.*
Flexible or Spring Medium of Suspension
— *Robert Schilling, General Motors Corp.*
Damping
— *B. E. O'Connor, Houde Engineering Division, Houdaille-Hershey Corp.*
Steering as Affected by Suspensions
— *C. F. Hammond, Gemmer Mfg. Co.*

Morning — Aircraft Powerplant

The German JUMO 004 Engine
— *Capt. W. C. Gerler, Air Technical Service Command*
Aircraft Engine Induction System Deposits
— *W. J. Sweeney, J. F. Kunc, Jr., and W. E. Morris, Standard Oil Development Co.*

Afternoon — Passenger Car

The Perfect Automatic Transmission
— *W. S. James, Ford Motor Co.*
Torque Converters?
— *R. J. Miller, Bendix Research Laboratories, Bendix Aviation Corp.*
Performance of Hydraulic Transmissions
— *A. H. Deimel, Spicer Mfg. Co.*
White Hydro Torque Drive
— *Renke Brunken, White Motor Co.*

Afternoon — Aircraft Powerplant

Symposium — Jet-Propulsion Powerplants
Some Factors Affecting the Design of Jet Turbines
— *W. R. Hawthorne, British Ministry of Aircraft Production*
Engineering Development of the Jet Engine and Gas Turbine Burner
— *F. C. Mock, Bendix Products Division, Bendix Aviation Corp.*
Mechanical Design Considerations Influencing Blading Performance of Aircraft Gas Turbine Powerplants
— *N. C. Price, Menasco Mfg. Co.*
Metallurgical Consideration in Aircraft Gas Turbine Design
— *N. L. Mochel, Westinghouse Electric Corp.*

★ ★

Evening — Dinner

Toastmaster — W. J. Davidson, General Motors Corp.
The Challenge of Human Engineering
— *Henry Ford II, Ford Motor Co.*

★ ★

MEETING and Engineering Display

Book-Cadillac Hotel, Detroit

THURSDAY, JAN. 10

Morning — Diesel Engine

Combustion Studies of the Diesel Engine
– E. W. Landen, Caterpillar Tractor Co.

Prepared discussions by:
– Phillip Myers and Otto Uyehara, University of Wisconsin
– Grover Wilson, Universal Oil Products Co.

Morning — Air Transport

All-Weather Flying Equipment
– Lt.-Col. E. A. Cutrell, Air Transport Command

All-Weather Flying Techniques
– John Gill, Eastern Air Lines, Inc.

Afternoon — Diesel Engine

Effect of Fuel Properties on Engine Performance
– F. G. Shoemaker, Detroit Diesel Engine Division, General Motors Corp.

Prepared discussion by:
– A. M. Rothrock, National Advisory Committee for Aeronautics

Combustion in a Pre-Combustion Type Diesel Engine
– H. F. Bryan, International Harvester Co.

Prepared Discussion by:
– H. M. Wiles, Waukesha Motor Co.

Afternoon — Air Transport

Review of Air Transport Development in America
– R. D. Kelly, United Air Lines, Inc.

Foreign Observations
– O. E. Kirchner, American Air Lines, Inc.

Evening — Production

Air Fixtures and Air Controls
– S. Johnson, Jr., Bendix-Westinghouse Automotive Air Brake Co.

Latest Developments in Honing Techniques
– L. S. Martz and D. T. Peden, Micromatic Hone Corp.

Evening

Horning Memorial Lecture
– C. B. Veal, Coordinating Research Council

FRIDAY, JAN. 11

Morning — Fuels and Lubricants

Motor Oils – Regular, Premium, and Heavy Duty
– H. R. Wolf, Research Laboratories Division, General Motors Corp.

Morning — Aircraft

Development of German Aircraft Hydraulic Systems and Equipment – Based upon Reports of a Government Technical Mission
– R. H. Davies, Parker Appliance Co.

Afternoon — Fuels and Lubricants

Gasoline Gum Tolerance of Ordnance Equipment (Report of CFR Committee)
– M. L. Alspaugh, Ethyl Corp.

A Review of the Development of Reference Fuel Scales for Knock Rating
– D. B. Brooks, National Bureau of Standards

Afternoon — Aircraft

Heat Recovery as Applied to the Heating and Anti-Icing of Aircraft
– J. Draney, Consolidated Vultee Aircraft Corp.

Design Trends in Aircraft Exhaust Systems
– R. L. Haver and H. A. Goodin, Jr., Ryan Aeronautical Co.

Evening — Standards

Engineering the Involute Spline
– G. L. McCain, Chrysler Corp.

Prepared discussions by:
– C. H. Stanard, Buick Motor Division, General Motors Corp.
– H. H. Gotberg, Colonial Broach Co.
– A. Beam, Vinco Corp.
– S. O. Bjornberg, Illinois Tool Works

SAE Annual Meeting DINNER

Fountain Room, MASONIC TEMPLE, 500 Fountain Street

HENRY FORD II

6:30 P. M. WEDNESDAY, JANUARY 9*

W. J. Davidson — Toastmaster

** January 9 is the correct date of this dinner. It was erroneously stated as February 9 in the November SAE Journal.*

SAE F&L MEETI DE
For Matching of Fue Lu

COMPILATION and coordination of fundamental knowledge essential to effective matchi of fuels, lubricants, and equipment for better service to the public became a stated r high-priority objective of automotive engineers and petroleum technologists at the SAE Fu & Lubricants Meeting at Tulsa, Okla., November 6 and 7.

More than 300 SAE members and guests attended the sessions, which were sponsored SAE Fuels & Lubricants Engineering Activity with the cooperation of SAE Mid-Contine Section. For two days and nights the sessions drew and held capacity crowds, which tax Mayo Hotel accommodations, established a new registration record for the meeting, a progressively shed coats and vests in seeking relief from the unseasonable 87 F heat.

SAE President James M. Crawford explained how the organization of the SAE Technical Board provides a medium for effective correlation of the cooperative search for fundamental knowledge essential to simultaneous progress in developing fuels, lubricants, and equipment. Development of correlated technological work for the solution of peacetime problems by this Board, Mr. Crawford said, assures postwar continuation of the activities of the SAE-API Coordinating Research Council with superior results from combinations of fuels, lubricants, and engines as the major objective.

Coordinating Fuels Research, Coordinating Lubricants Research, and Coordinating Equipment Research Committees, he explained, hereafter will work on a more generally cooperative basis through broader representation of all interests at the policy level and through wider distribution of all findings. The plans, he said, would also provide for increased representation of equipment manufacturers on committees active in the fuels and lubricants fields, and for the equipment committee to undertake work directly related to the better coordination of fuels, lubricants, and equipment.

Objective was stated to be harmonious collaboration between automotive engineers and petroleum technologists for better service to the public. CRC, he said, has been assigned the tasks of developing such cooperation in the technological field during the postwar era and of giving peacetime service to the public the same high priority as wartime service to the military.

Speakers and discussers throughout the meeting, covering all sectors of the technological front, stressed the close relationships between fuels, lubricants, and equipment. Technical data were presented to show that:

- Compilation of fundamental knowledge rates highest priority.
- Efficient results from combinations of fuels, lubricants, and equipment must begin in the design stages.
- Interdependence of fuels, lubricants, and equipment makes coordinated development mandatory.
- Adequate data can become available only through research so extensive, expensive, and involved as to require the fullest cooperation and coordination.
- Peacetime competition is no valid excuse for terminating wartime cooperati in the field of technology.
- Indexes such as cetane, octane, and v cosity numbers, are revelatory only specific characteristics.
- Overall qualities of fuels and lubr cants can be established only by prolonge exhaustive, and complicated laboratory a service tests with the widest possible vari of equipment and under extremes of cond tions.
- Addition of selected chemicals to dire fuels and lubricants is productive of pe formance results which, while still unde going examination, appear to be superior.
- Silicone fluids suggest the availabil of new types of non-petroleum lubrica highly resistant to heat, cold, and oxidati
- Progress in jet propulsion of aircra is dependent largely upon continued de velopments in fuels and metallurgy.

Wartime experience with British an American military aircraft was drawn up to show that lubricating oils compounde with detergents increase operating efficie and prolong the period between overhau Tests running to 200,000 and service ex ceeding 6,000,000, engine flight hours we said to have demonstrated that these lubr cants effectively minimize ring stickin deposits, and sludge.

Interim Service

It was explained that both the selecti of straight mineral oils and improvement in oil refining necessarily are limited, an that, pending the time when engine desig changes shall have been made and metal lurgy shall have progressed, "tailormade oils containing wear- and oxidation-inhib tors, and antifoam, antisludge, and oth additives will serve. Desirable objectiv which oil designers were advised to ai before them were listed as higher viscosi lower pour point, improved corrosion-a hibiting qualities, improved high-tempe ture stability, and better lubricity.

Prediction was made that complica

All papers presented at this SAE National Fuels & Lubricants Meeting will appear in a later issue of the *SAE Journal* either in full in the Transactions Section or as digests.

Under the general chairmanship of B. E. Sibley, the SAE National Fuels & Lubricants Meeting Nov. 6 and 7 in Tulsa, was one of the most successful in the Society's history. Serving with Mr. Sibley were J. H. Baird, local chairman; W. F. Lowe, treasurer; C. E. Tangner, and W. L. Thompson, members of the Committee on Arrangements.

Host of the event was the SAE Mid-Continent Section, which is headed by Arch L. Foster, chairman; Mr. Thompson, vice-chairman; B. C. Frichot, treasurer, and E. W. Cave, secretary.

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Chairman of the first Lubricants Session was M. D. Gjerde, Standard Oil Co. (Ind.), who introduced C. O. Tonberg, and R. E. Ellis, Standard Oil Development Co., and C. H. Baxley, Intavia, Inc., who had prepared a paper on the Application of Heavy-Duty Additives to Aviation Oils. Prepared and informal discussions were extensive.

●

The second Lubricants Session was presided over by A. O. Willey, Lubri-Zol Corp. He introduced L. E. Calkins, Willys-Overland Motors, Inc., who read a paper on Some Performance Characteristics of Detergent Motor Oils versus Non-detergent Motor Oils. C. H. Van Hartesveldt, Atlantic Refining Co., prepared a written discussion.

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Ralph Matthews, Battenfeld Grease & Oil Corp., was chairman of the Greases Session, at which E. W. Adams, Standard Oil Co. (Ind.) read a paper on Performance Testing of Wheel Bearing Lubricants. Prepared discussions were presented by Walter G. Ainsley, Sinclair Refining Co., and Major N. W. Faust, Army Ordnance Department. T. A. Kauppi and W. W. Pedersen, Dow Corning Corp., presented a paper on The Application of Silicones to the Bearing Lubrication Problem.

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Mr. Ainsley presided at the Diesel Fuels Session, where a paper on The Significance of Cetane Number in Fuels was presented by Com. E. F. Grieb, USNR, and Lt.-Com. C. S. Goddin, USNR. Another paper was presented by C. M. Larson, Sinclair Refining Co., on Diesel Fuel Additives Create New Concepts. Prepared and informal discussions of both papers were extensive.

●

SAE President James M. Crawford and C. B. Veal, Coordinating Research Council, were speakers at the session which followed the dinner on Nov. 6. Mr. Foster presided. The Wednesday dinner was presided over by Mr. Baird, who introduced the speaker, Charles J. Fay, Bell Aircraft Corp., who spoke on Jet Propulsion and Helicopters.

DEVELOPS NEED

Lubes, Equipment

J. C. Geniesse, vice-chairman of the Fuels and Lubricants Activity Committee, and J. M. Campbell, F&L meetings committee chairman

lubricating problems will exist so long as fuel must be charged with lead. These problems were described as sufficiently serious to demand systematic endeavors to solve them, with such objectives as reducing or eliminating deposits on valve stems, rings, and pistons; preventing rust and corrosion, especially during storage; reducing wear of moving parts; increasing the load capacity of gears; and developing such qualities as fireproofing and antifoaming.

Military secrecy was said to have handicapped progress in aircraft-engine lubricants by hampering discussion, particularly of difficulties. It was pointed out that some troubles improperly are ascribed to detergent oils – incorrect valve timing or even cowl design being the real cause.

Exchange of Data Needed

In this connection it was suggested that engine designers should provide petroleum technologists with pertinent facts and factors which will aid in establishing the relationship between the mechanical design of the engines and the types of lubricants they will require. Standardized test procedures, to be used alike by engine designers and petroleum technologists, were recommended.

Discussion of the use of detergent lubricants in motor vehicles raised questions as to the reliability of the results of limited tests and the desirability of providing comparable testing equipment and data. Report that use of detergent oils in automobiles led to increased consumption and reduced filter efficiency during the first 5000 miles of operation produced evidence from fleet experience to show that, over greater mileages, oil consumption is reduced.

Discussers declared that viscosity alone is no accurate index of the quality of detergent oils, and that the ability of such oils to keep piston rings free and oil holes clear contributes not only to superior lubricating efficiency, but to reduction in consumption. Consensus developed that much more extensive and comparable tests must be made before definite conclusions can be established. It was said that reduced filter efficiency might be expected because detergent oils keep sludge in suspension, with the result that it is removed from the engine, not by filtering, but by observing proper drain periods.

Reports of tests with detergents in motor vehicles which had seen considerable use were cited to indicate that these additive-type oils operate to clean the engines, to free the rings and oil controls, and to reduce consumption. It was pointed out additionally that the public is less interested in the controversy over types of lubricants and oil change periods than in the longer life of automotive equipment, and it was recommended that longer operating life for automotive equipment should be the primary objective of tests and developments.

Substantial Progress Made

Report of CRC activities during 1945 to date disclosed that more than 1500 technicians have been working cooperatively on 300 projects involving progress in fuels, lubricants, engines, and their interrelationships. Gear oil projects alone were reported to have involved nearly 20,000 laboratory and dynamometer tests and 2,000,000 miles of road tests. The aviation detonation program involved handling 24,000 gal of high-octane fuel. More than 21,000 gal of gasoline were made available for aviation oil tests. Trends were reported to be toward increased precision of test procedure, development and improvement of

cont. on p. 46

B. E. Sibley (left), general chairman of the Tulsa F & L Meeting, compares notes with SAE President James M. Crawford (right), who was a speaker at the session which followed the dinner on the opening evening of the meeting

About SAE

Dr. H. C. Dickinson

SAE Past-President **H. C. DICKINSON** retired on Oct. 26 as head of the Heat and Power Division of the National Bureau of Standards.

HARRY WENZEL has been appointed head of the Heat and Power Division to succeed Dr. Dickinson.

Dr. Dickinson was honored on the occasion of his retirement by a dinner attended by 300 friends and distinguished scientists. Speakers at the dinner who paid tribute to Dr. Dickinson's important contributions to science in general and automotive engineering in particular, included SAE Secretary and General Manager John A. C. Warner; Dr. Francis B. Silsbee, chief, Electrical Instrument Section, Dr. Harold F. Stimson, and Dr. L. J. Briggs, director, National Bureau of Standards. Clarence S. Bruce, automotive engineer, National Bureau of Standards, was toastmaster.

Dr. Briggs presented to Dr. Dickinson three specially bound volumes containing all of Dr. Dickinson's major contributions to technical literature. Responding to the appreciation of his friends and co-workers, Dr. Dickinson indicated that he would continue to cooperate with the Bureau of Standards in a consulting capacity while devoting the major part of his time to writing and other personal interests.

Dr. Dickinson has been associated with the Bureau of Standards since 1903. During the period from 1903 to 1918 he did experimental laboratory work dealing with problems connected with internal combustion engines. He served as research manager of the Society from 1921 to 1923. During this time, in 1922, he was appointed head of the Heat and Power Division of the Bureau. Dr. Dickinson, a life member of the Society, was a member of the SAE Council for the term 1934 to 1935.

Formerly assistant project engineer, Pratt & Whitney Aircraft, Division of United Aircraft Corp., East Hartford, Conn., **D. G. PHINNEY** will be associated with the West Coast field engineering office of the same company at Beverly Hills, Calif.

Before his induction into the USNR, **LEMUEL A. WILSON, JR.,** seaman second class, was receiving inspector at the Guiberson Corp., Dallas, Tex. He can be reached c/o Fleet Post Office, San Francisco.

LELAND D. COBB is now engineer on the general manager's staff of the New Departure Division of General Motors Corp., Bristol, Conn. He was formerly senior project engineer with the same division.

Formerly manager of the Spares Division of De Haviland Aircraft of Canada, Ltd., Toronto, Ont., Canada, **LLOYD J. DAVIS** has recently joined the Midland Foundry & Machine Co., Ltd., Midland, Ont., as sales manager for Canada.

JAMES A. SCOTT, JR., has been appointed director of research and development, Marshall-Eclipse Division, Bendix Aviation Corp., Troy, N. Y. He was formerly lubricating engineer, executive, engineering staff, Bendix Aviation Corp., New York City.

H. RAY ELLINWOOD has severed his connection as president of Adel Precision Products Corp., Burbank, Calif., to join National Machine Products, Los Angeles.

LT.-COL. JOHN S. TAWRESEY has recently been appointed vice-president in charge of engineering of the Bunting Brass & Bronze Co., Toledo, Ohio. In his new position, Colonel Tawresey will direct research and study of modern bearing design and applications in the light of advancements made during the war, and the requirements of modern mechanisms in all fields. He will have charge of all engineering related to the product, its manufacture, design, application, and improvement. Colonel Tawresey comes to Toledo from Wright Field, Dayton, Ohio, where he served as executive assistant to the chief of the Resources Control Section of the USAAF. Widely known as an authority on bearings and bearing applications, Colonel Tawresey holds a degree in mechanical engineering from the University of Pennsylvania, and has since his graduation from there in 1917 been prominently identified with engineering development of bearing applications in the automotive, aircraft, and industrial fields.

Lt.-Col. John S. Tawresey

After serving for four and one-half years in the USNR engaged in submarine and submarine maintenance service, **PAUL H. VERD,** recently reverted to inactive status with the rank of commander, has returned to the Elgin, Joliet & Eastern Railway Co., Gary, Ind., as master mechanic. He was diesel supervisor for the same company when he was called to active duty early in 1941.

ALEX PETROVSKY, formerly aeronautical engineer, National Advisory Committee for Aeronautics, Langley Field, Hampton, Va., has joined Republic Aviation Corp., Farmingdale, L. I., N. Y., as aerodynamics engineer.

RALPH E. MIDDLETON, vice-president, Aireon Mfg. Corp., has been named general manager of the corporation's Hydraulic Division at Burbank, Calif. He had been chief engineer there since 1941. Prior to his association with the Aireon organization, Mr. Middleton was connected with Curtiss-Wright Corp. as staff engineer on landing gear design.

Formerly field service representative, Pratt & Whitney Aircraft, Division of United Aircraft Service Corp., East Hartford, Conn., **ROBERT A. HINTERMISTER** has joined the U. S. Maritime Service.

WEBSTER H. FRANCIS, JR., has been elected vice-president and secretary of the Evans-Francis Corp., Baltimore, Md. He was formerly aeronautical engineer with the Glenn L. Martin Co., same city.

Formerly research engineer, McDonnell Aircraft Corp., St. Louis, Mo., **THOMAS J. HERRICK** is now assistant professor of aeronautical engineering, Purdue University, West Lafayette, Ind.

W. A. WISEMAN now holds the position of assistant chief engineer with Continental Motors Corp., Aircraft Engineering Division, Muskegon, Mich. He was formerly chief engineer, Warner Aircraft Corp., Detroit.

Formerly director of production planning, Thompson Aircraft Products Co., Cleveland, **RAYMOND Z. OSWALD** has joined Harry Ferguson, Inc., Detroit, as director of operations.

JOHN C. ENBLOM has been elected president and general manager of the St. Paul plant of the Donaldson Co. of St. Paul, Minn., and also president of the Donaldson Co. of Canada, Ltd., Chatham, Ont., Canada. Mr. Enblom, who was formerly executive vice-president and general manager of the St. Paul plant, succeeds the late **FRANK A. DONALDSON,** founder of the company. A graduate of the Institute of Technology, University of Minnesota, Mr. Enblom has been with the Donaldson organization since 1934. **F. H. FUNKE** has been appointed manager of the Detroit office and **C. D. WALTER** is now manager of the Chicago office of the Donaldson Co.

John C. Enblom

Members . . .

T. P. WRIGHT, Civil Aeronautics administrator, has been elected vice-chairman of the National Advisory Committee for Aeronautics. DR. J. C. HUNSAKER was re-elected chairman of the Committee and also chairman of the executive committee.

CHARLES W. MILLS, JR., formerly a major, Ordnance Department, Benicia Arsenal, Benicia, Calif., is now maintenance manager, California Truck Rental Co., Los Angeles.

PAUL R. GUERIN, Towmotor Corp., Cleveland, now holds the position of assistant chief engineer. He was formerly production engineer with the same firm.

On leave of absence from the Gulf Oil Corp., Atlanta, Ga., LT.-COL. WILLIAM H. FISHER, U. S. Army, is now battalion commander, 85th Training Battalion, Infantry Replacement Training Center, Camp Roberts, Calif. He was transferred from the 82nd Infantry Advance Training Battalion, Camp Maxey, Tex., where he was regimental executive officer.

ROBERT F. HODGSON has joined the Hydraulic Equipment Co., Cleveland, as design engineer. He was formerly installation engineer, Sales Division, Wright Aeronautical Corp., Paterson, N. J.

MERRELL A. WOOD, JR., has joined the Warren L. Baldwin Co., Lakewood, Ohio, as sales engineer. In his new position, Mr. Wood will be a manufacturer's representative and will be handling a variety of lines, such as small machine tools, plastics, utility furnaces, and so forth. While attending the General Motors Institute of Technology in 1934, he joined the Cleveland Diesel Engine Division of General Motors Corp. and was serving in the administration department of that division when he left to become sales engineer with the Baldwin organization. During 1939 and 1940 he was located at the World's Fair in New York City as sales engineer for the division. Mr. Wood has resigned as Cleveland Section Field Editor for the *SAE Journal* and as editor of the Cleveland Section Junior Journal, posts in which he has served the Section for several years.

Merrell A. Wood, Jr.

Formerly assigned as chief, Special Projects Unit, Control Equipment Branch, Equipment Laboratory, Air Technical Service Command, Wright Field, Dayton, Ohio, NICHOLAS POST has been appointed assistant for planning, Control Equipment Branch.

EDWARD W. STOCK has been appointed assistant to the president of the Trailmobile Co., Cincinnati, Ohio. He was formerly director, service, of the Fruehauf Trailer Co., Detroit.

ROBERT M. SALTER, JR., a lieutenant S(A) USNR, has been promoted to the rank of intelligence officer, powerplant design branch, Bureau of Aeronautics, Navy Department, Washington, D. C. He was formerly assistant intelligence officer, serving in the experimental engines section of the Bureau.

Formerly research engineer, General Motors Corp., Research Laboratories, Detroit, HOWARD B. FELDER now holds a similar position with the Clark Equipment Co., Buchanan, Mich.

GEORGE B. FRAUMANN, who has been serving in Kunming, China, as deputy chief,

Succeed to Section Chairmanships

T. R. Dinsmore

T. R. Dinsmore, previously vice-chairman, has become chairman of SAE Dayton Section for 1945-1946 following the resignation of Clyde H. Mitchell

Prof. Louis L. Otto, previously vice-chairman, has become chairman of SAE Syracuse Section for 1945-1946 following the resignation of W. W. Burrows

Prof. Louis L. Otto

T. R. DINSMORE, who since 1940 has been chief engineer for the Curtis Pump Co., Dayton, has been devoting his time to the design and development of aircraft accessories, especially aircraft fuel pumps. Before this he was chief engineer with McCauley Steel Propeller Co., where he worked chiefly on production problems connected with the manufacture of propellers. Active in SAE Dayton Section affairs since joining the Society in 1943, Mr. Dinsmore served as 1944-1945 secretary and treasurer.

LOUIS L. OTTO has been an assistant professor in the Automotive Engineering Department of Cornell University, Ithaca, N. Y., since 1942. He has distinguished himself as an instructor in courses in automotive chassis design and in the theory, design, and testing of internal combustion engines. Prior to his association with the University in 1938, he was a design engineer with the Kaustine Co., Inc., of Perry, N. Y. Professor Otto was 1944-1945 vice-chairman of SAE Syracuse Section.

Section Chairmen Resign Posts

Clyde H. Mitchell

W. W. Burrows

COL. CLYDE H. MITCHELL, who recently received his discharge from the USAAF and is reaffiliating with the Gates Rubber Co. of Denver, has resigned as chairman of SAE Dayton Section. He is situated in New York as district sales manager of the Gates firm for New York, New Jersey, and Connecticut. When he was elected chairman of Dayton Section, Colonel Mitchell was stationed at Wright Field as chief of the aircraft sub-section of the Aircraft Procurement Division.

W. W. BURROWS has left Syracuse, N. Y., to take up residence in Williamsport, Pa. This change of residence necessitated Mr. Burrows' resignation as chairman of the SAE Syracuse Section. He was for many years associated with the Aircooled Motors Corp., Syracuse, as assistant to the first vice-president and chief engineer.

Taking part in the groundbreaking ceremonies at the General Motors Technical Center were (left to right): SAE Past-President C. F. Kettering, vice-president in charge of GM Research Laboratories Division; SAE Past-President W. J. Davidson, directing engineer at the Center; and C. L. McCuen, vice-president in charge of GM Central Office Engineering Staff. Mr. Kettering scorned the traditional silver spade and substituted in its place an 18-cu yd earth mover

Foreign Economic Administration, Transportation Division, has returned to the United States and will make his residence in Arlington, Va.

Formerly a student member at the University of Detroit, **MARION M. TAYLOR** is now an engineer with the Bureau of Aeronautics, Navy Department, Washington, D. C.

GRANT W. KELLER, an ensign in the USNR, has been transferred from the Naval Air Technical Training Center, Memphis, Tenn., to the Naval Air Station at Moffett Field, Calif.

GUNNAR LARSSON, an engineer with A. B. Aerotransport, has transferred his headquarters from New York City to Stockholm, Sweden.

Formerly chief production test engineer, Dodge Chicago Plant, Division of the Chrysler Corp., Chicago, **U. A. PATCHETT** is now mechanical engineer with Jack & Heintz, Inc., Cleveland.

ROY C. PENROD has joined the Robert T. Oestreicher Co., Columbus, Ohio, as service and parts manager. He was formerly mechanical engineer, Office of the Chief of Ordnance-Detroit.

After 44 months of service in the USAAF, **COL. JOSEPH A. MOLLER** has returned to the Pure Oil Co. and is currently located in the company's central control laboratory in Northfield, Ill. Before returning to the United States in June, he commanded a heavy bombardment group of Flying Fortresses in the Eighth Air Force. Colonel Moller's record discloses that he led more heavy bombardment aircraft attacking enemy targets in Europe than any other living air commander. On early missions he piloted a Fortress, and later was combat leader. His awards and decorations include the Silver Star, the Distinguished Flying Cross with three oak leaf clusters, the bronze star, and many others.

Col. Joseph A. Moller

COM. OLIVER H. COTE, JR., is now the head of the structural modifications section of the Bureau of Aeronautics, Navy Department, Washington, D. C. He was formerly head of the Engineering Division, U. S. Navy, Aircraft 7th Fleet, c/o Fleet Post Office, San Francisco.

COM. RALPH BAGGALEY, JR., USNR, has been released to inactive duty and will return to the McCrady-Rogers Co., Pittsburgh. Before entering the Navy in 1942, he was superintendent of equipment for the McCrady-Rogers organization. His first assignment in the Navy was as assistant chief of diesel engine maintenance, Bureau of

Com. Ralph Baggaley, Jr.

Ships, Washington, D. C., where he had a vital part in getting diesel engines and spare parts ready for the landing craft which operated in the Navy's invasions. His last assignment was at the Naval Repair Base, San Diego, Calif., where he was technical adviser and liaison officer in the overhaul of landing ships on the Pacific Coast. Prior to his association with McCrady-Rogers Co. he was affiliated with the Pennsylvania Highways Department as equipment engineer.

COL. P. H. ROBEY, USAAF, is now chief of the Equipment Laboratory, Wright Field, Dayton, Ohio. Before this appointment he was stationed at the Marietta Air Base, Marietta, Ga.

Formerly assistant superintendent, assembly, Curtiss-Wright Corp., Indianapolis, Ind., **VINCENT SHANNON** has been appointed unit head, experimental assembly of the Propeller Division of the same corporation, Caldwell, N. J.

JOHN E. WALSTON, who was formerly civilian automotive adviser, U. S. Army, Camp Shelby, Miss., has recently joined the Motor Transit Co., Jacksonville, Fla., as superintendent of purchases and stores.

Formerly test engineer, Rolls-Royce Division, Packard Motor Car Co., **CLOYD DICKERSON** is now experimental engineer in the Detroit Division of the Packard organization.

RICHARD S. HUESTED, formerly manager of the Washington office of Curtiss-Wright Corp., Washington, has recently been appointed administrative assistant to the general manager of Wright Aeronautical Corp., Paterson, N. J.

Until recently service engineer with the Waterbury Tool Co., Division of Vickers, Inc., Waterbury, Conn., **HARRY H. BROWN, JR.,** is now service manager with the Brown and Thomas Auto Co., New Haven, Conn.

FRANK J. BREITSAMETER, a fireman first class in the USNR, is at present serving in Tokyo. He was previously stationed at the Naval Repair Base, Internal Combustion Engine School, San Diego, Calif.

Before joining the Navy, **EUGENE G. LENTZ** was service engineer, Lycoming Division, Aviation Corp., Williamsport, Pa. He is now stationed in Chicago, Ill.

Formerly owner and manager of the Art Baker Transportation Garage, Los Angeles, Calif., **H. E. MEAD** is now the owner of Ed. Mead Diesel & Truck Repairing, same city.

Formerly scheduling officer, War Production Board, Washington, **HARRY R. DE SILVA** may now be reached c/o the Surplus Property Administration, Washington, D. C.

K. B. HOPFINGER has joined Girling, Ltd., Birmingham, England, as development engineer. He was formerly associated with Glyn, Mills & Co., London.

E. J. LUXMOORE, who was formerly with Chevrolet Motors, Division of General Motors Corp., Flint, Mich., is now located in the Chevrolet-Central Office, Detroit.

TOM SPALDING is now manager and field engineer, Jack & Heintz, Inc., Cleveland, Ohio. He was previously assistant to the president of the same company with headquarters in Bedford, Ohio.

DR. E. N. KEMLER has been appointed head of the newly created Engineering Research Division of the Southern Research Institute, Birmingham, Ala. Dr. Kemler comes to the Institute from Purdue University where he was professor of mechanical engineering. He has been associated with several companies in a consulting capacity and was previously employed by Dodge Mfg. Corp., the University of Michigan, and other research organizations. During the war years he was engaged in teaching and research work for the Armed Forces at Purdue University.

Dr. E. N. Kemler

JOSEPH H. **BURROUGHS, JR.,** has joined Cargocaire Engineering Corp., New York City, as designer. He was formerly chief checker in the design department, Elco Naval Division, Electric Boat Co., Bayonne, N. J.

Until recently engineer, Dodge Chicago Plant, Division of the Chrysler Corp., Chicago, **EDMOND B. COOPER** is now automotive engineer with the Standard Oil Co. of Ind., Whiting, Ind.

ENS. WILLIAM S. LOGAN, USNR, formerly employed as test and development engineer with the Chrysler Corp., Detroit, is now attending the Aviation Engineering Officers' School, Naval Air Technical Training Center, Memphis, Tenn.

FORD L. PRESCOTT has been named research engineer, College of Engineering, University of Florida, Gainesville, Fla. He was formerly principal mechanical engineer working on aircraft engines, design and development department, USAAF, Wright Field, Dayton, Ohio.

Formerly liaison engineer, Illinois Division, Bendix Aviation Corp., Chicago, **W. J. HALL** is now assistant customer engineer, Bendix Products Division, South Bend, Ind.

LIDIA MANSON has joined the De Laval Steam Turbine Co., Trenton, N. J. She was formerly associated with Clark Bros., Inc., Olean, N. Y.

MILTON BREITMAN is now business representative dealing in engineering and estimating for the Breitman Iron Works, Bronx, N. Y. He was formerly field engineer, Chance Vought Aircraft, Division of United Aircraft Corp., Stratford, Conn.

Formerly chief checker, tool design department, Robbins Engineering Co., Detroit, **IRVING L. ROSS** is now a sergeant in the U. S. Army and is stationed at Sheppard Field, Tex. He is serving as flight engineer on bombers.

BERYL Van LIEROP, who had been designer, Detroit Gear Division, Borg-Warner Corp., Detroit, has joined the U. S. Rubber Co., same city, as machine designer.

NIKOLA TRBOJEVICH has been appointed research and consulting engineer, Jack & Heintz, Inc., Cleveland. Mr. Trbojevich, a noted mathematician, inventor, and gear expert, came to the United States in 1914. After taking engineering courses both at Northwestern University and Western Electric Co., he became an engineer with the Illinois Tool Works, Chicago. Since then he has been an independent inventor and consulting engineer. His most notable work was the development of a new type of spiral bevel and hypoid gearing together with tools and machines for its manufacture.

Nikola Trbojevich

C. O. DOHRENWEND has been appointed director of the department of mechanics, Illinois Institute of Technology, Chicago. He was formerly in charge of engineering mechanical research, Armour Research Foundation, same city.

Formerly chief design engineer, Romec Pump Co., Elyria, Ohio, **LELAND MELVIN** is now associated with the A. W. Hecker Co., Cleveland.

Formerly at the Detroit Institute of Technology, Detroit, **HARLAN HOUGHTBY,** a private in the U. S. Army, is now stationed at Camp Grant, Ill.

A. C. BOOCK, Allis-Chalmers Mfg. Co., Springfield Works, Springfield, Ill., has been named chief engineer. He formerly held the position of assistant chief engineer.

Formerly mechanical engineer, Stillwater War Industries, Inc., **JOSEPH L. BECKER** is now assistant general manager of the same company.

LT.-COL. M. F. WEILL, who has recently become a civilian after serving since 1941 with the Ordnance Department, is returning to the Ethyl Corp. as a field engineer and will make his headquarters in Los Angeles. Entering active duty in 1941 as a captain from a reserve status, he served as commanding officer of a Fourth Army heavy maintenance company on the West Coast. A year on the general staff at Head-

Lt.-Col. M. F. Weill

quarters Western Defense Command, Fourth Army, was followed by another year on the special Ordnance staff of the same headquarters. He was transferred to Detroit in 1943 on a tour of duty on the staff of **BRIG.-GEN. JOHN K. CHRISTMAS,** and was appointed in 1944 chief of the Technical Branch, Maintenance Division. For the past nine months Colonel Weill has headed the planning and control functions of the Maintenance Division, Office of the Chief of Ordnance, Detroit.

Before joining the Navy, **R. KENNEDY SMITH,** an ensign in the USNR, was an engineer with the Parker Appliance Co., Cleveland. He is now catapult officer aboard the U. S. S. Badoeng Strait and may be contacted c/o Fleet Post Office, New York, N. Y.

FRANCIS LIEBER has been elected president of Service Carriers, Inc., Wilmington, Del. He was formerly an aviation consultant.

RUSSELL S. ATKINSON has joined Dynamic Air Engineering, Inc., Los Angeles, as engineering sales manager for the Chicago district. He formerly held the position of chief engineer with Aero Engineering, Inc., Cleveland.

L. H. SMITH has been appointed vice-president in charge of engineering of the General American Aerocoach Co., Division of the General American Transportation Corp., Chicago. He is at present engaged in the engineering of the new Aerocoach buses for both the city-transit and intercity fields.

L. H. Smith

Prior to joining the Aerocoach organization in March, 1940, Mr. Smith was in charge of new engine design for the Chrysler Corp., and then coach designer at General Motors Yellow Coach Division. In June, 1940, he set up the experimental engineering department at Aerocoach and began work on the first pilot model of the present Mastercraft Aerocoach. Mr. Smith will make his headquarters in Chicago.

F. R. NAIL has been named assistant to the chief engineer in charge of highway trucks, Mack Mfg. Corp., New York City. He had been assistant chief, Engineering Branch, U. S. Army, Office of the Chief of Ordnance-Detroit.

P. M. HELDT has now completed his series of books on automotive engineering with the publication of "The Automotive Chassis." Intended both as a reference work for engineers and as a textbook for students, the book deals with the various parts of the chassis, with the exception of the powerplant. In many cases, shortcomings of earlier designs are pointed out, and the reasons for their abandonment made clear. Rules for the proportioning of parts are given, together with numerous illustrations of stock parts—a helpful and stimulating procedure for the designer. Many of the design formulas are developed from basic principles, thus increasing the educational value of the volume. The book contains 583 pp. and includes 380 illustrations. It is available from Mr. Heldt, Nyack, N. Y., for $6.00.

Previously project engineer, Dodge Chicago Plant, Division of the Chrysler Corp., Chicago, **L. B. BORNHAUSER** has recently become production engineer, Plymouth Division of the same corporation, Detroit.

CHARLES S. DOERR now holds the post of service manager with the White Motor Co., Philadelphia, Pa. He was formerly director, M. V. Services, Federal Works Agency, Washington.

FRED H. LOCKWOOD has set up offices in Chicago as public relations counsel. He was previously affiliated with the E. B. Mathewson Co., same city.

ARTHUR W. YODER is now assistant lubrication engineer, Socony-Vacuum Oil Co., Inc., Philadelphia, Pa. He was formerly process engineer with Wright Aeronautical Corp., Paterson, N. J.

Southern California Section was host to one of the most successful aeronautic meetings in history in Los Angeles on Nov. 1. Members of the Section's Governing Board, which was largely responsible for the five-session, all-day engineering meeting, are Gerthal French, chairman; Duff Dean, vice-chairman, Fred H. Rohr, chairman, San Diego; Ralph Middleton, vice-chairman for aircraft; Burnham Adams, vice-chairman for aircraft powerplant; Thomas Wolfe, vice-chairman for air transport; Robert L. Johnson, secretary, and Charles H. Jacobsen, treasurer.

War-Born Aero De
Set Pace for

by T. D. MacGREGOR

WARTIME experience of the aviation industry has enabled it to make innumerable advances. More important, it has hastened recognition of the existence of manifold inadequacies and unsolved problems – problems which aviation research is attacking vigorously, drawing on past experience, but looking toward the demands of the future. This was disclosed clearly at the Southern California Section's Victory Aeronautical Engineering Meeting at the Biltmore Hotel in Los Angeles, Thursday, Nov. 1. This full-day session was the second and last part of this year's Aeronautical Meeting, supplementing the sessions that were held on Oct. 4. This second part was as well attended as the first with an average for the daytime sessions of more than 200, and a capacity crowd of 400 engineers attending the evening symposium.

The Icing Symposium, held during the morning session, presented a paper on A Report on the Nature of Ice Formation on Aircraft as Related to Airline Operation by Capt. C. M. Christensen, United Airlines, and another on The Airplane Icing Problem and Its Alleviation through Applied Research by Alun R. Jones of the NACA. Thus the subject was covered by an operator and a research analyst.

Aeronautical experts examined aircraft from nose to tail, pointed out their inefficiencies, and indicated the steps that are being taken and will be taken to correct them.

One of the chronic and most troublesome aircraft diseases is that of ice formation: chronic because ice will form on any exposed part of any airplane, large or small, under given conditions (as yet not completely determined), and troublesome because of its interference with normal performance and control of the airplane.

Describing the nature of ice formation and its effect on airline operations, Capt. C. M. Christenson, of United Airlines, emphasized the fact that it is not a rare or occasional problem in the first paper at the Icing Symposium. Icing is a serious concern during several months of the year. Its effects on the performance of the plane are dangerous and, at the same time, unpredictable. Some of the results which may be expected, he said, are interference with the reliability of instruments, antennae failure and power failure. The process of ice formation is determined by a number of factors some of whose behavior is not known, such as the rate of accretion, the temperature and the altitude, and the character of ice type and formation. This last in turn depends on the size and character of the particles of water or ice, the temperature, and so on.

Knowledge should be sufficient to enable forecast of the location and altitude where the condition will prevail. More should be known about the process of formation, the rate of accretion, of turbulence and subsidence, and the levels of escape. Also important is the establishment of standard terminology and reporting procedure, so that the airmen and the meteorologists may discuss the problem. Most important of all, he said, the problem must be solved on the drawing board, not in the overhaul shop. Anti-icing equipment should be built into aircraft parts, not added as an afterthought.

Progress Cited

Complicated and far from solution though some of these problems are, Alun R. Jones, NACA, assured the meeting that progress has been continuous, if not altogether satisfactory, since NACA research on icing began in 1928. He outlined the fundamental requirements for de-icing procedure which have been determined by research. Heat has so far seemed the best protection for all affected parts. Conditions whose establishment probably would provide adequate protection against icing are a 100 F temperature rise in dry air for all points on wing and empennage surfaces in front of a 10% chord; a heat flow of 1000 Btu per hr per sq ft of windshield surface, and 3 to 5 watts per sq in. of surface area forward of 20% of the propeller chord.

The patterns which future research should follow, he said, are clearly indicated. First, to establish a rational basis for design of de-icing equipment, it will be necessary to denominate a "limit" icing condition in which equipment will be expected to function adequately. Before this can be done, a great deal more must be known about the factors which cause ice formation, about its probable occurrence along established air transport routes, and about the exact effect of such factors as temperature, altitude, and the amount of free water during accretion. In addition to these questions of cause and effect, Mr. Jones pointed out, there is the important problem of when ice becomes a hazard.

It will not be necessary, he believes, to provide against all accretion at all times. The limit can probably best be determined by actual experience. Mr. Jones is certain that a large-scale icing wind tunnel would help to solve most of the outstanding problems of de-icing. He believes, too, that if the present rate of successful research is maintained, ice will soon cease to be a hazard.

During discussion, Dr. A. L. Klein, Douglas Aircraft Co., Inc., asked about the advantages of internal control horns. He felt that such controls might cause a tendency to flutter, but would eliminate icing trouble. Capt. Christensen replied that they had very little trouble with external control horns, particularly if they were shielded. Asked about trouble due to water runback on the wing, he said his airline had no trouble with icing aft of 40% chord. They did not believe that runback would be a serious problem.

Mr. Jones stated that NACA had very little information on problems involved in the thinner air-foil sections now so much used, but supposed that the new Cleveland tunnel would bring some answers. Dr. Klein commented that some of the German planes having heat de-icing were noted to have the ducts well filled with grass clippings. He pointed out that the systems now being designed are completely uncleanable. Mr. Messenger of Lockheed commented that dirt in heating ducts might be prevented by a closed system. He understands that Germans have used exhaust gases directly for heating with no heat exchanger. He asked if any information was available. Mr. Jones replied that NACA had not worked on this problem but would do so if there seemed to be sufficient interest. When asked about the corrosion effects due to condensation of water in the exhaust products, the author said the NACA was trying to get some answers to this question but in the meantime felt that if the exhaust gas was dumped at a temperature above the dew point, no serious problem would exist.

Capt. Christensen pointed out that, aside from corrosive products of combustion, the water included in the exhaust gas was no worse than rain, which was always encountered.

Simultaneously, a Power Plant Session was held under the chairmanship of Gunnar Edenquist with two very excellent papers by T. F. Hammen, Jr.,*and W. H. Rowley, Ranger Aircraft Engine Co., covering the installation problems of the formerly much maligned inline engines and a paper covering An Electrical Model for the Investigation of Crankshaft Torsional Vibrations in an Inline Engine by Hugh B. Stewart, Allison Division, General Motors Corp. This session permitted equal participation by the two

Developments for Research

most prominent companies in the inline engine field.

Discussing factors involved in the installation of the inverted inline aircooled engine, Messrs. Hammen and Rowley described cooling aspects, cowling arrangements, oil cooling systems, induction systems, engine mounts and exhaust systems. The cooling air flow is derived from the plane's forward velocity, the fan effect of the propeller, and the pumping effect of airflow past the cowl flaps. The latter depends on the shape, area and location of entrance and exit, and the design of the pressure chamber.

Baffle Is Described

Among recent successful developments described are the "turbulent flow" baffle, which completely boxes the cylinder and induces local turbulence within the enclosed area, in order to maintain maximum thermal potential between cooling fin and cooling air by a scrubbing action; the Al-fin process, which makes use of an aluminum muff with cooling fins machined into it to improve heat transfer of a finned cylinder to the cooling-air stream, and "bi-polar cooling," a method for delivering cooling air to both the downstream and upstream sides of the cylinder which considerably reduces cooling power requirements. Experiments are in process for incorporating this last into a cowling installation which will admit all required cooling and carburetor air through a common inlet.

The authors believe that with the adoption of efficient design principles to handle all these questions, it will not be long before custom power plants will be adaptable to a wide range of aircraft.

Investigates Torsional Vibration

Considering the problem of crankshaft torsional vibration with relation to inline engines, Mr. Stewart pointed out that increased engine power has served to emphasize this problem. Torsional vibration often leads to failures in engine parts or propeller. One of the most important aspects of engine designing, he said, is fore-knowledge of the effect of changes of design on torsional vibration.

The author described the electrical model which has been developed by Allison as a more rapid and simpler method of determining torsional vibration than the Holzer tabulation method. The model makes it possible, according to Mr. Stewart, to determine the natural frequencies and relative amplitudes of vibration in an engine system.

The torque into any part of the crankshaft or the propeller can be found, and the effectiveness of different pendulum damper tunings be estimated. In these and other tests conducted, he said, good agreement has been experienced between actual engine results and the results shown by the model, so that it has proved to be a valuable instrument.

The afternoon session held the attention of the members and guests by a "Brake Symposium" arranged by E. W. "Pop" Cleveland, an exponent of hydraulic equipment. The program consisted of papers by K. C. Monroe, Vickers, Inc., and E. F. Loweke, Hayes Industries, Inc., with a prepared discussion by E. K. Lasswell of the ATSC and Howard Field, Jr., hydraulic consultant.

The Role of Accumulators

The role of the accumulator as an important part of the airplane hydraulic system was described by Mr. Monroe. Its purpose is to provide storage of fluid under pressure as potential energy for momentary delivery to the system in addition to the delivery from the pump. The accumulator is recharged with fluid by the pump as a battery is recharged by a generator. In early aircraft, he said, accumulators were not necessary because a very small pump could operate continuously against low pressure with a relief valve acting as a pressure regulator, bypassing back to the reservoir any fluid not required for use. Pumps now are generally driven mechanically by the engine, so that the standard practice is to provide an unloading valve, or pressure regulator, which will permit the discharge of the pump to bypass the pressure system after the accumulator is fully charged.

Pointing out that the conventional type of accumulator used on most industrial installations would have to weigh over six tons to be adequate to aircraft requirements, Mr. Monroe said that the spherical type of accumulator has so far produced the best results in all types of aircraft service, from the point of view of minimum weight, minimum overall dimensions, maximum displacement and maximum life span.

Power Brake Valves

Another design problem accentuated by the increasing size and power of modern aircraft is that of the power brake valve. Mr. Loweke explained that not only would a conventional power brake valve installed in a large present-day plane be quite inadequate, but also the problem is augmented by the confining effect of aerodynamic design in dictating the limitations of installations and their performance.

Discussing the relative merits of balanced and unbalanced type valves, the author said that while the balanced valve is normally almost frictionless and thus has almost infinite increment control, the use of different metals may bring about freezing up due to differences in contraction, and these valves are more sensitive both to scoring by foreign particles and to leakage.

On the other hand, while the unbalanced valve is not so responsive in increment control because of the unbalanced forces, it gives a lesser time lag. One particular advantage of the unbalanced valve, according to Mr. Loweke, is that its friction and inertia, or breakaway force, produces the possibly beneficial result of preloading the load spring and delaying the response of the load feel piston.

Thus the valve will be prevented from assuming a premature hunting position, will remain open longer and provide a greater

turn to p. 51

SAE Aeronautical Work Highly Praised

SAE aeronautical committee work on preservation and packaging of aeronautical materials and equipment is praised as "a very definite and essential contribution to successful culmination of the war" in a letter received by the Society from Rear Admiral E. D. Foster, aviation supply officer, USN.

Pointing out that insurance of delivery of Navy aeronautical equipment and material in a ready-to-use condition was a major factor in victorious logistics – and that wartime shipping and handling conditions and the rigors of extreme foreign climate presented unparalleled problems – Admiral Foster writes:

"These were overcome only by the unremitting effort and cooperation of industry in collaboration with technical personnel of the services. Outstanding among these programs, and the results obtained, were those conducted for the services with the manufacturers by the SAE Aeronautical Department.

"Will you please accept," he concludes, "for the SAE and Mr. E. W. Rentz, Jr., and extend to all participants and members of the several committees and subcommittees on preservation and packaging of aeronautical materials and equipment, the lasting appreciation of this office for a very definite and essential contribution to the successful culmination of the war, particularly in so far as aeronautics was concerned."

The SAE committee which achieved the results so highly rated by Admiral Foster was Committee A-13, whose chairman was P. J. Kondla of Pratt & Whitney Aircraft. The committee itself – composed of men who acted as chairmen of the 16 subcommittees which worked under the direction of the main group – consisted of: R. G. Anderson, Sperry Gyroscope Co., Inc.; G. F. Cavanagh, Jack & Heintz, Inc.; L. A. Danse, General Motors Corp.; H. N. Droge, Kollsman Instrument Division, Square D Co.; C. M. Elliott, Eastman Kodak Co.; R. P. Lambeck, Hamilton Standard Propellers; H. A. Lockwood, Chandler-Evans Corp.; J. W. Meeks, Harrison Radiator Division, GMC; A. F. Pennington, Titeflex Metal Hose Co.; S. Ragonnet, Fairchild Camera & Instrument Co.; H. D. Stolcenburg, Bendix Products, Division of Bendix Aviation Corp.; H. H. Vogel, Champion Spark Plug Co.; L. J. Weber, General Electric Co.; and R. R. Zoeller, Lawrence Aeronautical Corp.

SAE Coming Events

National Meetings

AIR TRANSPORT ENGINEERING, Dec. 3-5, Edgewater Beach Hotel, Chicago

ANNUAL MEETING & ENGINEERING DISPLAY, Jan. 7-11, 1946, Book-Cadillac Hotel, Detroit

AERONAUTIC (Spring), April 3-5, 1946, New Yorker Hotel, New York

Baltimore – Dec. 13

Engineers Club; dinner 7:00 p.m. Old Timers Night. Speakers – W. F. Kneip, general manager, Maryland Motor Truck Association, Inc. A. H. Bishop, vice-president, Autocar Sales & Service Co. Talks illustrated with slides showing pictures of early Horseless Carriage.

Cincinnati – Dec. 13

Alms Hotel; dinner 6:30 p.m. Trends in Post-War Truck and Engine Design – Merrill C. Horine, sales promotion department, Mack Mfg. Corp.

Cleveland – Dec. 10

Cleveland Club; dinner 6:30 p.m. Speaker and subject to be announced.

Dayton – Dec. 5

Van Cleve Hotel; dinner 6:45 p.m. Future Automotive Design – William B. Stout, Graham Paige Motors.

Detroit – Dec. 10 and 17

Dec. 10 – Horace H. Rackham Educational Memorial Building, dinner 6:30 p.m. Past, Present and Future of Jet Propulsion – Major General Benjamin Chidlaw, Wright Field.

Dec. 17 – Horace H. Rackham Educational Memorial Building; meeting 7:30 p.m. Will Light Metals Influence Passenger Car Design? (A) Forging & Casting, (B) Sheet Metal. Speakers: L. W. Kempf will cover castings and forgings; J. H. Dunn will cover sheet metal and R. B. Mears will talk on corrosion. All three men with Aluminum Co. of America. Potential Applications of Magnesium in Automotive Vehicles – Dr. J. C. Mathes, development engineer, Dow Chemical Co.

Indiana – Dec. 13

Antlers Hotel, Indianapolis; Development and Trends in Automatic Transmissions – Harry R. Greenlee, L. G. S. Spring Clutch Corp.

Kansas City – Dec. 11

Continental Hotel; dinner 6:30 p.m. Speaker and subject to be announced.

Metropolitan – Dec. 13

Pennsylvania Hotel, New York; meeting 7:45 p.m. Operational Engineering in the Eighth Air Force – Col. B. Kelsey.

Mohawk-Hudson Group – Dec. 12

DeWitt Clinton Hotel, Albany; dinner 6:45 p.m. Speaker – F. N. Wilcox, engineer, General Electric Co.

Northern California – Dec. 14

Engineers Club, San Francisco; dinner 6:15 p.m. Lubricating Oil Grease – L. W. McLennon, supervisor, Union Oil Co.

Northwest – Dec. 7

Gowman Hotel, Seattle; dinner 7:00 p.m. Speaker and subject to be announced.

Oregon – Dec. 14

Imperial Hotel; meeting 7:00 p.m. Maintenance and Its Relation to Public Transportation – E. B. Richardson, superintendent of equipment, Portland Traction Co.

St. Louis – Dec. 11

Congress Hotel; dinner 6:30 p.m. A Glimpse Into the Future of the Diesel Engine – C. G. A. Rosen, director of research, Caterpillar Tractor Co.

Southern California – Dec. 7

Biltmore Hotel, Los Angeles; meeting 8:00 p.m. Passenger Cars. Speaker and subject to be announced.

Spokane Group – Dec. 14

Desert Hotel; dinner 7:00 p.m. Fleet Maintenance – Walter T. Thorsen, Greyhound Lines.

Twin City Group – Dec. 6

Curtis Hotel, Minneapolis; dinner 6:30 p.m. Valves and Valve Testing – Vincent Ayres, engineer of valve train parts, Wilcox-Rich Division, Eaton Mfg. Co.

Washington – Dec. 13

Dodge Hotel; dinner 6:30 p.m. Engine Wear – Clarence S. Bruce, automotive engineer, National Bureau of Standards.

Wichita – Dec. 13

Broadview Hotel; dinner 6:45 p.m. Magnesium Alloys and Their Application – J. C. Mathes. Motion Picture film.

Student Branch News

"THE Diesel Engine in Automotive Transport" was the title of a paper presented by P. E. Biggar, GMC Truck and Coach Division at the Oct. 3 meeting of the SAE Branch of General Motors Institute. Mr. Biggar discussed the advantages and limitations of both diesel and gasoline engines and outlined the present position of the diesel in its use for automotive power.

Steve Cenko was elected vice-chairman, Section A of the GMI SAE Branch, and George Kendro was voted secretary-treasurer.

Capt. M. G. Beard of American Airlines addressed the SAE Student Branch of the College of the City of New York at its Oct. 10 meeting. Discussing the "Next Five Years in Commercial Aviation," Capt. Beard declared that in five or ten years the New York City area will be demanding many times the number of operations now possible at La Guardia Field. He viewed the proposed multi-runway Idlewild airport as the answer to the need for greater facilities. Also on the horizon Capt. Beard saw faster, larger, more comfortable aircraft and possible consideration of unconventional craft. Objectives of commercial aviation include improved electronic equipment to overcome weather hazards, improved weight designs, better engines, higher wing loading, and improved passenger comfort.

Duis W. Meador, Wright Aeronautical Corp., presented an illustrated paper on fuel injection mechanisms at the Oct. 24 meeting of the CCNY SAE Branch. Mr. Meador outlined the exacting demands which must be made of injection equipment and declared that extreme precision is required in manufacturing. The end product is justifiable in that it offers substantial saving in fuel dollars and cents. It is probable he indicated that production costs of injection equipment eventually will be slashed and the advantages over the carburetion system will be brought into prominence.

Wednesday, Nov. 7, the CCNY SAE Branch was host to Herman Jackes, Jr., of Wright Aeronautical, who discussed and demonstrated the application of high speed photography to the study of events in an aircraft engine. Film which had been exposed at the camera speed of 2500 frames per sec was projected at 16 frames per sec, disclosing improper valve action and other phenomena not otherwise detectable. Mr. Jackes indicated that a camera capable of taking pictures at the rate of 8000 to 12,000 frames per sec is being prepared. Limitations are the tensile properties of the film, and the available candlepower needed to properly expose the film.

The SAE Club of Fenn College launched the current year's activities with a business meeting on Oct. 16. Sam Close was voted chairman of the Club; Dan Votypka, vice-chairman; Leonard Gerlat, secretary; and Manfred Massa, treasurer.

Dr. J. T. Rettaliata, guest speaker at the Sept. 25 meeting of the University of Wisconsin SAE Branch, described the development and use of the gas turbine. Illustrating his lecture with slides, Dr. Rettaliata dealt with the history of the gas turbine, its construction, the thermodynamics of the cycle, and the gas turbine's present and proposed applications.

New officers were elected to assume administration of the University of Wisconsin SAE Branch at the Oct. 9 meeting. George Hlavka was voted chairman; Arthur Schmitt, vice-chairman; Mildred Smith, secretary; and Archie Kowalik, treasurer.

Check List of SAE Meetings Papers

Here are listed those papers presented before National and Section Meetings of the Society of Automotive Engineers, which are still available in mimeographed form.

The SAE policy, in respect to mimeographed copies of these papers, is to make them available for at least one year after presentation.

The following papers, divided under four general headings for your convenience, are available at 25 cents to SAE Members and 50 cents to Non-Members. Ten or more mimeographed papers of any one title are available at reduced rates from the Special Publications Department, Society of Automotive Engineers, 29 West 39 Street, New York 18, N. Y.

NEW Papers This Month

Check Here	Author	Title of Preprint of Paper	Date of Presentation
	Adams, E. W.	Performance Testing of Wheel-Bearing Lubricants	Nov. 6-7, 45
	Christenson, C. M.	A Report on the Nature of Ice Formation on Aircraft as Related to Airline Operations	Nov. 1, 45
	Doman, Carl T.	General Requirements for Helicopter Engines	Nov. 1, 45
	Eaton, D. C.	Cruising Economy By Use of Water Injection	Nov. 1, 45
	Griep, Com. E. F. Goddin, Lt. Com. C. S.	Significance of Cetane Number in Fuels	Nov. 6-7, 45
	Hanley, W. V. Hundere, A.	Economics of Airline Fuel Utilization	Nov. 1, 45
	Jones, Alun R.	Airplane Icing Problem and Its Alleviation through Research	Nov. 1, 45
	Kauppi, T. A. Pedersen, W. W.	Silicones as Lubricants	Nov. 6-7, 45
	Knight, J. E. Baxley, C. H.	Modern Aircraft Refueling	Oct. 4, 45
	Larson, C. M.	Diesel Fuel Additives Create New Concepts	Nov. 6-7, 45
	Tongberg, C. O. Ellis, R. E. Baxley, C. H.	Application of Heavy Duty Additives to Aviation Oils	Nov. 6-7, 45

Papers Previously Announced

Vehicles

	Austen, Robert N.	Maintenance Engineering of Chassis Leaf Springs	May 9, 45
	Bentz, E. J. H.	Diesel Cold Starting Problems	June 11, 45
	Burke, John D.	The Practical Postwar Car — Report of Automobile Body Survey Conducted by the San Francisco Examiner	Jan. 8-12, 45
	Burkhalter, R. R.	Truck and Bus Transmissions	Oct. 10, 44
	Churchill, H. E.	The Weasel	March 19, 45
	Colby, Col. J. M.	Contribution of Industry to Ordnance Tank-Automotive Engineering	Jan. 8-12, 45
	Collins, Tom. J.	Post-War Diesel Engines	Feb. 12, 45
	Colwell, A. T.	Alcohol-Water Injection	Jan. 8-12, 45
	Colwell, A. T.	Fuel Requirements for Farm Tractors	Sept. 13, 44
	Davis, Francis W.	Power Steering for Automotive Vehicles	Jan. 8-12, 45
	Fageol, L. J.	Possibilities and Limitations of Post War Bus Design for City Transportation	Dec. 14, 44
	Fageol, F. R.	Advantages of Multi-Power Plants in Motor Buses	Jan. 8-12, 45
	Ford, Lee H	Recent Developments in One-Man-Operated Farm Machines	Feb. 1, 45
	Gohn, E. P.	Post War Truck Selection and Conditioning	Feb. 12, 45
	Gohn, E. P.	Cold Starting and Fleet Operation	Jan. 8-12, 45
	Hebert, Gordon	The Practical Postwar Car — Report of Automobile Body Survey	Jan. 8-12, 45
	Herold, Richard	Supercharged Two-Stroke Cycle Diesels	Nov. 9, 44
	Horine, Merrill C.	Engineering Features of an Off-Highway Truck	Jan. 19, 45
	Hunt, J. H.	The Future of SAE Automobile Standards	Jan. 8-12, 45
	Kettering, C. F.	Fuels and Engines for Higher Power and Greater Efficiency	Jan. 8-12, 45
	Kishline, F. F.	Probable Post-War Automobile Design Trends	Dec. 1, 44
	Lautzenhiser, F. B.	A Non-Technical Discussion of Diesel vs. Gasoline Power Plants in Motor Trucks	Jan. 8, 45
	Lowske, E. F.	Power Brake Valves	Nov. 1, 45
	Oetzel, J. G.	Post War Brakes	May 10, 45
	Park, Bryan	Over the Road Diesel Operation	May 15, 45
	Peirce, T. H.	Bonded Rubber Torsional Vibration Dampers for Diesel Engines	Jan. 8-12, 45
	Pierce, Bert	The Practical Postwar Car	Jan. 8-12, 45
	Rendel, T. B.	Post War Internal Combustion Engines and Their Fuels	Dec. 14, 44
	Stemmons, C. O.	Rubber Tracks for Agriculture	Sept. 13, 45
	Taylor, C. Fayette	Effect of Engine Exhaust Pressure on the Performance of Compressor Turbine Units	Oct. 4, 45
	Twyman, L. R.	Hydraulics as Applied to Tractors and Farm Machinery	Sept. 13, 45
	Vincent, E. T.	Piston Development Review	Jan. 8-12, 45
	Wilson, H. D.	Report of Automobile Body Survey conducted by the Chicago Herald American	Jan. 8-12, 45

Aeronautics

	Bachle, C. F.	Some Possibilities of Turbine Compounding with the Piston Engine	Jan. 8-12, 45
	Beal, G. F.	Making the Cockpit Practical	Jan. 8-12, 45
	Beard, M. G.	Future Operational Requirements in Relation to Cockpit Design	Oct. 5-7, 44
	Bergen, Com. J. J.	Some Observations on the Financing of Local Air Transport	Jan. 8-12, 45
	Berry, B. M. Rollins, F. S.	Aviation Lubricating Oils	Aug. 24, 45
	Brown, Merle Hoffman, Luther Griffin, J. R. Jr.	Cockpit Lighting	Nov. 17, 44
	Campbell, Kenneth	Some Advantages and Limitations of Centrifugal and Axia Aircraft Compressors	May 7, 45
	Campbell, Kenneth	Engine Cooling Fan Theory and Practice	April 5-7, 44
	Carroll, W. F.	Airports in Southern California	Jan. 11, 45
	Chase, Capt. J. H.	Analytical Fuel Reserve Systems for Long Range Aircraft	Oct. 5-7, 44
	Colin, Lt. R. J., Jr.	Electronic Controls in Aircraft	Jan. 8-12, 45
	Costa, Philip J.	Detonation in Flight — Its Effect on Fuel Consumption and Engine Life	Jan. 8-12, 45
	Cunningham, J. W.	High Conductivity Cooling Fins for Aircraft Engines	May 1, 45
	Dietrich, F. J.	Aircraft Riveting and Equipment	May 1, 45
	Dirckson, Maj. A. D.	Aircraft Lighting	Jan. 8-12, 45
	Dolza, John	Coordination of Fluid Coupling Driven Auxiliary Supercharger Speed to Engine Manifold Pressure	Jan. 8-12, 45
	Edwards, M. L.	Performance of the Air Oil Separator in Engine Breather Systems	April 24, 45
	Etchells, E. B. Underwood, A. F.	Silver Bearings	May 7, 45

Aeronautics Continued

Check Here	Author	Title of Preprint of Paper	Date of Presentation
_____	Field, Howard	Reduction of Vulnerability of Aircraft Hydraulic Systems	April 19, 45
_____	Foster, J. N.	Application of High Production Methods to Reduced Production	Oct. 5-7, 44
_____	Fraas, Arthur P.	Flow Characteristics of Induction Systems	Jan. 8-12, 45
_____	Friedlander, J. W.	Operating Costs of Personal Airplanes	May 7, 45
_____	Gardiner, Duncan B.	Electronic Analysis of Airplane Hydraulic Braking Systems	Jan. 8-12, 45
_____	Gates, Hon. A. L.	Naval Aviation Today in the Pacific	Feb. 5, 45
_____	Gordon, Kenneth	Control Cabin Development	Jan. 8-12, 45
_____	Gray, H. C. Jenny, R. W.	Chafing on Aircraft Engine Parts	April 5-7, 44
_____	Gregg, David	Cabin Superchargers	Oct. 5-7, 44
_____	Herrmann, K. L.	New Light Weight Power Plants for Post War Airplanes	Nov. 9, 44
_____	Hicks, R. D.	Service Experience with Light Aircraft Engines	May 7, 45
_____	Kelley, Bartram	Helicopter Stability with Young's Lifting Rotor	March 19, 45
_____	Kelly, R. D.	A Means of Warning of Incipient Breakdown of Smooth Air Flow of Airfoil Surfaces	Oct. 5-7, 44
_____	Kendrick, J. B.	Applied Aero-Economics	Jan. 8-12, 45
_____	King, W. J.	Axial versus Centrifugal Superchargers for Aircraft Engines	May 7, 45
_____	Klein, Dr. A. L.	Fundamentals of Airplane Design	April 5-7, 44
_____	Knight, William	Stresses in Disc Wheels	April 5-7, 44
_____	Landgraf, F.	Helicopter Design Problems	Nov. 1, 45
_____	Lingle, Col. D. G. Seitz, Capt. G. A.	Army-Navy Aeronautical Standardization	Reprinted – Nov. 42 SAE Journal
_____	Loomis, R. C.	Cruising Control of Transport Aircraft	Oct. 5-7, 44
_____	Loudenslager, O. W.	Structural Model Testing	May 1, 45
_____	Lusk, Capt. R. J.	Protection of Electrical Systems on Military Aircraft	April 24, 45
_____	McFarland, F. R.	Aircraft Engine Gears	May 7, 45
_____	MacNeil, C. S.	Propellers and Air Transport	Nov. 17, 44
_____	Magruder, P. M.	Future Trends in Intercontinental Transport Aircraft	Jan. 4, 45
_____	Maloy, Raymond B.	A Resume of Desirable Characteristics for Non-Stalling, Non-Spinning Airplanes	May 7, 45
_____	Mentzer, W. C. Mitchell, E. C.	Cargo Tiedown and Stowage	Dec. 4-6, 44
_____	Moon, C. L.	Mechanized Handling of Airplane Cargos	Dec. 4-7, 44
_____	Moreton, D. H.	Problems Involved in Airframe Lubrication	Aug. 24, 45
_____	Mullen, H. A. Boelter, L.	Aircraft Spotwelding at Willow Run	May 1, 45
_____	Nutt, Arthur	The Future of Standardization in the Aeronautical Industry	Jan. 8-12, 45
_____	Parks, M. J.	Cargo Airplane Accessories	Dec. 4-6, 44
_____	Parvin, D. R.	What About the Age of Flight? Air Transportation in the 5 years to follow the war.	Jan. 5, 45
_____	Prewitt, R. H.	Basic Factors of Helicopter Design	Jan. 8-12, 45
_____	Rawdon, Herb	Wood Versus Metal Aircraft Construction	Oct. 20, 44
_____	Rawdon, Herb	Requirements of the Feeder Line Airplane	Dec. 4-6, 44
_____	Reichel, W. A.	War Lessons in Testing of Accessories and Instruments	Oct. 5-7, 44
_____	Richards, W. M. S.	The Prediction of Engine Cooling Requirements by a Graphical Method	Oct. 5-7, 44
_____	Robinson, Ray	The Postwar Market for Personal Planes	May 7, 45
_____	Rodriguez, D. L.	Wartime Aircraft Service Problems — Their Solution	June 19, 45
_____	Rowe, M. R. Ladd, G. T.	Water Injection for Aircraft Engines	Aug. 24, 45
_____	Rudd, J. K. Heath, Westcott	Radio Interference and the Aircraft Engine	Oct. 5-7, 44
_____	Schirtzinger, J. F.	The Development of Spar Caps with Integral Fittings	Oct. 5-7, 44
_____	Schleicher, R. L.	A Current Outlook on the Effects of Dynamic Loads on Aircraft	Oct. 5-7, 44
_____	Schweitzer, P. H. Sharples, L. P.	S-S System of Lubrication for Aircraft Engines	Oct. 4, 45
_____	Sheets, J. H. MacKinney, G. W.	Reverse Thrust Propellers for Use as Landing Brakes for Large Aircraft	Oct. 5-7, 44
_____	Shue, G. S.	Compressibility	Sept. 19, 44
_____	Smith, G. G.	Crewless Craft	Dec. 4, 44
_____	Smith, Robert L.	Potentialities of Air Cargo as a Merchandising Aid	Jan. 11, 45
_____	Stafford, Paul H.	Trends in Airport Runway Design	Jan. 8-12, 45
_____	Streett, John W.	The Detection of Detonation and other Operating Abnormalities in Aircraft Engines by Means of Special Instrumentation	Jan. 8-12, 45
_____	Wachs, Miller A.	Building Utility into the Helicopter	Feb. 7, 45
_____	Warner, Edward	International Airworthiness Standards	Jan. 8-12, 45
_____	Weeks, W. L.	Factors in Aeration and Deaeration of Aircraft Engine Oil	Oct. 4, 45
_____	Weick, Fred	Four Years of Simpler Flying with Ercoupes	Oct. 5-7, 44
_____	Wendell, E. E. Warden, H. H. Kerr, H. H.	Weight Reduction of Aircraft Braking System thru the Use of Reverse Thrust Propellers	Oct. 4, 45
_____	Williams, G. L. Miller, A. B.	Primary Balancing of Radial Engines	Jan. 8-12, 45
_____	Wolfe, Thomas	Shipping by Air	Dec. 6-8, 44
_____	Wood Carlos Croshere, A. B.	A Proposal for the Establishment of Commercial Air Cargo Service	Dec. 4-8, 44

Fuels and Lubricants

Check Here	Author	Title of Preprint of Paper	Date of Presentation
_____	Ambrose, H. A. Trautman, C. E.	Engine Oil Foaming	Jan. 8-12, 45
_____	Becker, C. F.	Gasolines — Past, Present, Future	Dec. 1, 44
_____	Berry, B. M. Rollins, F. S.	Aviation Lubricating Oils	Aug. 24, 45
_____	Brabbs, Lt. A. D.	Testing Heavy-Duty Lubricating Oils for Naval Service	Nov. 9-10, 44
_____	Brandes, Dr. O. L. Donaldson, H. H. Jr.	Use and Evaluation of Heavy Duty Engine Oils	May 9, 45
_____	Cattaneo, A. G. Bollo, F. G. Stanly, A. L.	A Petroleum Research Engineer's Outlook on Fuels for Conventionally Powered and Gas Turbine Aircraft	Aug. 24, 45
_____	Effmann, Karl H.	Engine Oil Consumption Determination	March 8, 45
_____	Galindo, Lt. Com. H. L.	Navy Experience With Diesel Fuels and Lubricants	May 17, 45
_____	Georgi, Carl W.	Detergency or Dispersancy in Heavy Duty Engine Oils	Nov. 9-10, 44
_____	Holaday, W. M. Mount, W. S.	Discussing the Fuels and Lubricants Supply Problem	May 15, 45
_____	Keyser, Paul V.	Progress Report on Gear Oils Projects-CRC	Jan. 8-12, 45
_____	Penfold, Norman C.	Some Comments on Engine Testing of Heavy-Duty Oils	Nov. 9-10, 44
_____	Pigott, R. J. S.	Considerations Affecting Fuels and Lubricants from the War Work	Jan. 16, 45
_____	Ronan, J. T.	Motor Oil Performance	Dec. 11, 44
_____	Savard, A. J.	Fuel Vapor Recovery	Feb. 20, 45
_____	Wright, W. A.	A Survey of Past and Present Trends in Lubricating Oil Additives	Nov. 9-10, 44

Miscellaneous

Check Here	Author	Title of Preprint of Paper	Date of Presentation
_____	Aufmuth, R. B.	The Practice of Powder Metallurgy	March 12, 45
_____	Erwin, Wesley S.	The Sonigage, A Supersonic Contact Instrument for Thickness Measurement	Oct. 5-7, 44
_____	Frye, Col. J. H.	Metallurgy of Foreign Automotive Materiel	Jan. 8-12, 45
_____	Jackson, P. B.	Aluminum After the War	March 14, 45
_____	Osborn, H. B. Jr.	Tocco Hardening	Jan. 8-12, 45
_____	Painter, Richard Huber, Paul	Technique for Practical High Speed Motion Pictures	Jan. 8-12, 45
_____	McBrearty, J. F.	Utilization of New High Strength Aluminum Alloys	Oct. 4, 45
_____	Miller, Roy A. Tatman, Max E.	Shop Aspects of the New High Strength Aluminum Alloys	Oct. 4, 45
_____	Porter, F. P.	Methods for Calculating Torsional Vibration	Jan. 8-12, 45
_____	Sanders, Morris	Wartime Fabric Developments of Significance to the Automotive Industry	Jan. 8-12, 45
_____	Somes, Howard E.	Induction Head Treatment of Internal Surfaces as Applied to Automotive Industries	Jan. 8-12, 45
_____	Strothman, E. P.	Some Cases for Steel as a Material	Jan. 8-12, 45
_____	Swoboda, L. F.	Advantages and Characteristics of Light Metal, Permanent Mold Castings	Oct. 5-7, 44
_____	Riesing, E. F.	Synthetic Rubber Mechanical Parts in Present and Post-war Vehicles	Jan. 8-12, 45
_____	Vaughn, F. F.	Induction Hardening as Applied to Farm Machinery	Sept. 13, 45

Limited supply of older SAE Meetings Papers in mimeographed form is also available. A permanent file of SAE Meetings Papers is kept in the SAE Library, from which photostatic copies can be made, upon request, at cost.

SAE VETERANS AVAILABLE

Following are briefed experience records of SAE veterans of World War II who are seeking employment through the SAE Placement Service. Interested employers are invited to address inquiries by number to SAE Placement Service, Society of Automotive Engineers, 29 West 39 St., New York 18, N. Y.

Detailed experience records may be obtained for confidential consideration.

5037 Automotive Engineer, 52, honorably discharged U. S. AAF Jan. 1, 1945, after serving overseas as Major and Lt. Colonel, experience in research, lubrication, as mgr. of sales petroleum co., super-service stations; can handle fleet operation, take complete charge of shops and can handle men. Available immediately. Resident – Chicago, location open.

5039 Prod. Engr., 37, experienced in aircraft engine maint., working for Army Air Depot, discharged soldier World War II, 10 points preference with Civil Service Comm., foreign languages French and German, available now. Resident – Utah, location preferred – East or Europe.

5096 Transp. Engr. and Supt. of Automotive Maint., 56, experienced heavy duty equipment both diesel and gasoline powered, has had wide experience in field inspections, also setting up and teaching in automotive schools. Speaks French and German. Will consider foreign service. Army service. Has had charge of large shops, maint. of all types of motor cars and trucks for manufacturer, dealer and fleet owner. Resident – N. Y. C., available immediately.

5099 Mechanical Engineer, 27, experienced in aircraft engine and spark plug testing and general aircraft inspection. Now in Army, desires maint. engrg. position with an airline. Will accept U. S. or foreign location. Resident – Pa.

5102 Young Grad. Aero. Engr., 26, with 3 yrs. experience, desires engrg. position involving coordination of design, tooling and prod. depts. Discharged veteran AAF. Willing to undertake advanced schooling in preparation for possible future executive position in organization. Has completed one yr. grad. work in business adm. Resident – Ohio, prefers New England or Midwest location.

5127 Fleet Operation, Maint. and Service Supt., 48, wide experience in truck transportation, also heavy equipment such as road equipment and cranes. Recently discharged U. S. Navy "Seabees" after 2 yrs. in South Pacific Islands. Resident – Calif., location open.

5132 Grad. Aero. Engr., 30, experience in aircraft engine installation, prod. engine testing, engine experimental engrg. and wind tunnel testing. Desires position in prod. engrg. with opportunities in prod. management. Resident – Penn., location open.

5133 Aero. Engr., 45, married, dependent, lawyer, admitted legal practice 12 yrs., grad. Naval Engineer, 8 yrs. experience mostly aeronautical; BS, LLb. Naval Eng. JSDr.; supervisory experience in research, design, electric, physical and hydraulic testing, magnetos, highly precision equipments. Quality control organizer. Desires position with airline and/or where legal and engrg. knowledge and experience both useful. To be released USAAF Sept. 30, 1945, also served in World War I as test pilot (flying boats). Resident – N.Y.C., prefers N.Y. or foreign location.

5134 Aero. Engineer, 31, 8½ yrs. experience in airline, aircraft engine co., aircraft co. and Army Air Forces, desires permanent connection in aeronautical industry or engrg. sales. Resident – Calif., location open, foreign considered.

5157 Service Mgr. or Sales Service Engr., 39, 12 yrs. experience for mfr. of industrial engines (gas diesel), automobiles, trucks, marine engines, tractors, road building equipment or allied automotive equipment. Resident – Detroit, prefers Midwest location.

5165 Naval Officer, 40, ME and MME degrees, available soon, 20 yrs. experience gasoline and diesel engine development, research, motor coach fleet operation, executive ability, lab. direction. Resident – L. I., prefers L. I. or Met. N. Y. location.

5174 Grad. Mech. Engr., 23, honorable discharge U.S.A., 16 mos. experience designing precision instruments, electro-mechanical devices. Capable of assuming responsibility. Resident – N.Y.C., prefers N. Y. C. location or vicinity.

5186 Navy Test Pilot, 29, 8 yrs. aero. design and flying experience, ME degree. Desires sales engrg., contact, dev. or test work. Will travel anywhere. Available immediately. Resident – Penn.

5188 Supt., Fleet Operations and Maint., 28, 5 yrs. experience Army Operations and Maint. Officer (475 vehicles), gasoline and diesel equipment. BS in ME. Resident – c/o Postmaster, San Francisco, Calif., prefers West or Northwest location. Available Jan. 1, 1946.

5205 Sales or Service Promotion, grad. ME, 42, recently Captain Marines, desires connection with car, truck or parts manu. or major oil co. 20 yrs. experience. Location open, available immediately, resident – N. Y.

5216 M.E. Grad., M.I.T., 26, former Naval officer, experience toolmaker, has held CE and Prod. Mgr. positions in metal fabrication and assembly. Available immediately. Resident – N. Y., location open.

5217 Tool Process Engineer, 30, married, veteran Army Air Forces, physically fit, 10 yrs. wide practical experience tool and gage mfg. and inspection. Available immediately, temporary resident – Denver, Colo., prefers Detroit area.

5218 Industrial Engineer, General Foreman, Prod. Mgr. or Supt., 43, Army officer (Major), transferred to inactive duty, 20 yrs. experience in machine tool field, in handling and supervising personnel. Best of character. Available immediately. Resident – Va., location open.

5219 Production Engineer, 33, grad. EE, 7 yrs. experience supervising manu., prod. and inspection of automotive parts, 4 yrs. as project and liaison officer on tracklaying vehicles for Ordnance Dept. Resident – Mich., location open.

5220 Commercial Engineer, with Master's degree in Automotive Engrg., 30, 2 yrs. experience in automotive engrg., 4 yrs. as project officer, Capt. U. S. Army, on tank dev. Desires position as project or sales engineer in automotive or related field. Resident – Detroit, prefers Midwest or Southern location.

5224 Mech. Engr., 22, BS at MIT, BME at RPI, veteran, desires position with firm doing consulting or dev. work. Resident N.Y.C., prefers N.Y.C. location.

5228 Mech. Engr., 26, with 3 yrs. diesel operation and maint., 1 yr. diesel engine repair. Desires development, field service or sales internal combustion field. Prefers eastern location, resident – N. J.

Army Thanks SAE for Aid

THE Army has officially thanked the SAE for its cooperative work on limits of wear engine parts, developed by the SAE Ordnance Vehicle Maintenance Committee on Engine Limits and Tolerances.

The committee undertook an extensive survey of vehicle operators to obtain the data, which was later checked with vehicle manufacturers by the Office of the Chief of Ordnance-Detroit, before inclusion in the various military manuals.

The data are a guide to mechanics as to when certain parts should be discarded rather than repaired. The problem was particularly acute when the survey was made because of the shortage of critical materials and parts at that time.

The text of the letter from General Wells follows:

"This office wishes to express its deepest appreciation to the Society of Automotive Engineers for its splendid aid and cooperation with this office in establishing Wear Limits for use in overhaul of Army Vehicle Components.

"As a result of the information obtained, Wear Limits were established on forty-two (42) Standard Ordnance Engines and Power Trains. These data were published and distributed to Ordnance Shops which were engaged in the rebuilding of automotive equipment. General use of these data made possible a great saving of both material and man hours.

"We are very grateful to you for the valuable assistance you have rendered to this office."

Sincerely yours,
(signed)
G. M. WELLS
Brigadier General, Ordnance Department
Commanding

Safety as a prerequisite to economy was the theme of **SOUTHERN CALIFORNIA SECTION** T&M Meeting, Oct. 26. Col. F. C. Lynch pointed out that a superficially minor accident may throw an axle or frame out of line and sharply increase operating costs. Training of personnel in the importance of safety is a vital necessity, he said. In a paper on the fundamentals of training operators, J. W. Sinclair presented a simple and concise formula of "do's" and don'ts" for safe and economical driving.

Considerable discussion arose over the question of brake testing of commercial vehicles. It was agreed that present method of subjecting trucks and buses to braking tests without load is inadequate and inefficient.

We may not expect to have atomic power for running automobiles or heating homes very soon, according to Dr. Marion L. Pool of Ohio State University. Dr. Pool, who has been conducting extensive research on atomic energy, told the **DAYTON SECTION** on Sept. 26 that future experiments may be directed more toward exploring the common elements. For example, he said, the process of developing the sun's energy is ten times more efficient than that of producing the atomic bomb.

Describing the development of U-235, the source of power for the atomic bomb, Dr. Pool said that there are no large concentrations of the element, because any concentration reaching the size of the critical mass would explode. This of course applies to the artificial extraction pile as well. Methods of counteracting this tendency to pre-explosion in the Oregon pile, which Dr. Pool compared in size to the 12-story hotel in which the meeting was held, include the use of layers of cadmium to absorb the slow neutrons which crack the U-235 nuclei, and the utilization of the Columbia River as a cooling agent.

Dr. Pool believes that with war-accelerated experimentation, our state of knowledge of atomic power has now reached approximately the stage which under normal conditions would have been approached in the year 2000.

Reporting to Dayton Section on "Gas Turbine Metallurgy," E. M. Philips of General Electric Co., stated that the basic principles of today's turbine are quite similar to those of early steam turbines, which date back to 1791. Lack of materials has been the greatest handicap to the developmnt of the gas turbine, Mr. Philips pointed out, because of the high heat required for efficiency.

Three SAE past-presidents speaking to Nov. 1 **METROPOLITAN SECTION** meeting poked nostalgic fun at some of the old automobiles, discussed present engineering problems, and made predictions for the future. (See pp. 18-19 for digests.)

(Left to right) John Bion, Metropolitan Section Vice-Chairman for Passenger Car and Body Activity, Speakers William B. Stout, William S. James and Henry Crane

MILWAUKEE SECTION Meeting, Nov. 2, heard Alex Taub describe trials and tribulations of his automotive experience in wartime England. Based largely on this experience, and on his contacts with technicians from other nations, is his definition of what the trend in trucks and passenger cars should be. In passenger cars he hopes to see such improvements as lighter weight, more passenger room, the return of the 4-cyl engine in lower priced cars, use of opposed cylinders, 4 and 6, more elastic piston rings, front wheel drive, and an engine capable of 40 to 45 mpg. Aspects he considers important for trucks are increased size in volume production, flat opposed engines, placed amidships, frame-automatic shift two-speed axles, tuning of engine for mpg, salt cooled valves, multiple spark plugs, and positive drive differential. Mr. Taub also pointed out that while durability has become a less important consideration in this country because of road improvement, the large potential foreign market should interest manufacturers in attempting improvements in both durability and fuel consumption.

Einstein's energy-mass equivalent theorem stated in 1905 accounts for the production of atomic energy, O. W. Baird, professor of physics, San Diego State College, told **SAN DIEGO BRANCH** on Oct. 31. Only two radioactive substances having the necessary large mass change have yet been isolated on the scale necessary for atomic bombing, Mr. Baird said. One is uranium-235, a natural isotope of uranium. The other is plutonium, an artificially created element. Plutonium is easier to produce and extract, he said, because large-scale chemical processes may be employed, and its raw material, U-238, constitutes 99.3% of natural uranium, as contrasted with 0.7% for U-235. In its present form, he pointed out, atomic power could not be used for automotive power.

Rambling Section

"Gas Turbine and 550 mph Aeroplanes Already a Reality" was the title of a paper presented by John F. Bailor of General Electric Co. before the **NORTHERN CALIFORNIA SECTION,** Oct. 8. Mr. Bailor described the speed spectrum for aircraft, a series of calculations covering all speed ranges from zero for the free balloon to 25,000 mph for meteors entering the earth's atmosphere. The spectrum also shows the curve of propeller efficiency as a function of speed, and the curve of horsepower required to drive a given frame, also as a function of speed. Mr. Bailor explained that the limit on speed of a propeller driven airplane is set by the propeller efficiency curve: efficiency increases as speed rises up to nearly 500 mph, then begins to decrease. However, there is no such inherent limitation on jet-propelled aircraft, for the aerodynamic design of the air frame containing the engine sets the only limit. By the use of temperature entropy diagrams and appropriate values of temperature and pressure ratio, Mr. Bailor demonstrated how the increase of turbine wheel temperature and the pressure ratio will increase gas turbine efficiency. Minimum efficiency of 60% for turbine and compressor would be needed to drive the turbine alone, he said.

Mr. Bailor reported that aerodynamicists believe jet or rocket engines with proper aircraft design may reach and exceed the speed of sound. Example of a faster-than-sound aircraft now in experimental stage described by Mr. Bailor is the athodyd, a jet-propelled duct whose minimum speed is 650 mph.

Mr. Bailor's talk concluded with slides showing some of the present jet propulsion aircraft, including the Bell P-59 twin engine jet propulsion plane, and the P-80 Lockheed Shooting Star.

SAE JOURNAL

Baltimore – Webster H. Francis, Jr.
Buffalo – No Appointment
Canadian – Warren B. Hastings
Chicago – Austin W. Stromberg
Cincinnati – Charles W. Coote
Cleveland – Richard E. Brown
Dayton – W. D. Hazlett
Detroit – W. F. Sherman
Hawaiian – Al Molloy
Indiana – Harlow Hyde
Kansas City – Harold F. Twyman
Metropolitan – Duis W. Meador
Mid-Continent – No Appointment
Milwaukee – L. A. Wilson
New England – Arnold R. Okuro
No. California – J. H. MacPherson
Northwest – No appointment
Oregon – No Appointment

Through Reports

Reduced passenger and freight rates, increased employment, and more widespread service have resulted from the increase in air travel made possible by the development of commercial aircraft, George Fuller of United Airlines told **WASHINGTON SECTION** meeting, Nov. 8. Probable sources of even greater progress are larger planes with greater speed and cruising range, and radar to nullify weather. In the order of their importance, Mr. Fuller pointed out, the three basic factors vital to commercial airlines are safety, passenger comfort and speed. A lively question and discussion period followed.

Controversial discussion at **WESTERN MICHIGAN SECTION** meeting, Oct. 18, followed presentation by E. B. Etchells, GMC Research Laboratories of a paper on "Silver Bearings" (SAE Journal, September, 1945). Opinions expressed: lead plate with Indium overplate prevents seizure of silver bearings . . . lead plate prevents sloughing, Indium resists corrosion . . . lead tin is just as good for corrosion as any bearing material . . . crankshaft and bearing wear can be reduced by finishing crank journals with plateau finish.

C. O. Tongberg of Standard Oil Development Co. spoke to **PHILADELPHIA SECTION**, Nov. 14, on "Application of Heavy Duty Additives to Aviation Oils." Mr. Tongberg's presentation included a statement of necessary improvements in aviation oil qualities, among them rust prevention, reduction in engine wear, improved low temperature characteristics and non-inflammability. Discussion was concerned chiefly with the economic value of detergent oils; general conclusion was that they have a definite value for most types of engines.

FIELD EDITORS

Peoria – No Appointment
Philadelphia – Laurence Cooper
Pittsburgh – No Appointment
St. Louis – C. C. Butterworth
So. California – T. D. MacGregor
So. New England – Claude O. Broders
Syracuse – No Appointment
Texas – No Appointment
Washington – E. K. Owens
Western Michigan – No Appointment
Wichita – No Appointment
Colorado Group – No Appointment
Mohawk-Hudson Group – No Appointment
Salt Lake Group – David Brown
Spokane Group – No Appointment
Twin City Group – George S. Johnson
San Diego Unit – Grant B. Hodgson

On behalf of Mid-Continent Section members, a certificate of appreciation was presented to 1944 Mid-Continent Chairman John E. Baird on Nov 7. William F. Lowe (left) makes the presentation, while W. E. Thompson (right) stands by

We may see six million automobiles and one million trucks produced in a single year in the near future, according to A. T. Colwell, vice-president of Thompson Products, Inc. Addressing 100 members and guests of the **PITTSBURGH SECTION**, Oct. 30, Mr. Colwell said that although any radical changes in passenger car design probably will come from small manufacturers, there is a definite trend toward compact engine types with few cylinders. He pointed out that the 16-cyl engine has gone, the 12 is going, and the straight 8 will probably not last long because it takes up too much room and its long heavy crankshaft is subject to torsional vibration and roughness. Thus he believes most engines will return to V-8 or 6-cyl, with 4-cyl engines in the cheaper cars. Mr. Colwell's opinion of rear engine mounting is that its disadvantages outweigh its advantages. Mr. Colwell emphasized the mutual debt of the aircraft and automobile industries. The automobile industry, he said, contributed the use of strong, light steels, precision manufacture, and mass production, while aircraft found it necessary (and also possible) to ignore the cost factor, thus perfecting parts which have since through mass production techniques come down in cost to truck level.

Feeder line operator requirements are hardly approximated by current aircraft, according to Bowman R. Otto, president of Feeder Airlines Association. Speaking before **DETROIT SECTION** Aeronautics Meeting, Oct. 10, Mr. Otto outlined requirements drawn up by the Technical Committee of Feeder Airlines Association. Attention is focused, he said, on economy of operation, low altitude and small airport performance, rapid loading and refueling facilities, and passenger comfort. These specifications mean a high wing all metal transport with at least two engines, space for 18 to 22 passengers, and cargo space for 1500 to 2000 lb.

Howard Ailor, president, National Fly Ur-Self Systems, Inc., blames designers of personal planes for failing to take proper consideration of public needs and wishes. He believes that one and two engine passenger planes built to efficient specifications of weight, speed, range, and useful load could sell for $4000 and $12,000 respectively, on a production schedule of about 10,000.

Arthur B. Schultz, chief engineer of All American Aviation, Inc., estimated that with airmail pickup and feeder line operation, aviation will be able to serve 90% of the nation, as against 30% by trunk lines alone. Available means of increasing aircraft utility described by Mr. Schultz include thousands of new airports, use of helicopter-type aircraft, extensive use of air pickup and feeder line service, and fast surface transportation to and from terminals.

A 50 to one increase in non-scheduled flying, and a yearly expenditure of $1 billion are predicted by John H. Geisse, assistant to the Administrator of Civil Aeronautics for Personal Flying. By a conservative estimate, he said, we will probably have 4½ million pilots in ten years, with more being trained each year.

At Detroit Section Production Activity Meeting, Oct. 15, Ralph M. Heintz, vice-president of Jack & Heintz, Inc., and J. C. Fox of Doehler-Jarvis Corp., described the growth of the die casting industry during the war. Mr. Heintz explained that die casting as used now is a pressure casting process, and that metal inserts and threads are cast in the die casting to eliminate machining operations. Advantages of die castings over usual sand castings are strength, smoothness, closer tolerances held, faster production. Cost is offset by elimination of machining and reduction of manhours. Three fundamental qualities emphasized by Mr. Fox as most important to die design are strength, accuracy and uniformity.

Application of high-strength adhesives in fabrication of automotive parts and assemblies was discussed by D. L. Swayze of Chrysler Corp., at Detroit Section meeting, Nov. 1. Mr. Swayze emphasized the continuity of bonded joints, making possible reduction of metal gages, and freedom of design permitted by the wide variety of materials that can be bonded in many combinations. He pointed out that the mass of data now available on important properties, as well as standardization of tests and new testing methods, will ensure future progress.

Discussion, led by Dr. Howard E. Fritz of B. F. Goodrich Rubber Co., was chiefly concerned with a resume of past problems and their solution, and a rehearsal of present applications of adhesive techniques.

SAE Torsional Vibration Report Turned Over to Navy at Ceremony

COMPLETED report on current industry practice in handling the torsional vibration problem was officially presented to the U. S. Navy by the SAE War Engineering Board's Committee on Torsional Vibration at Norfolk Navy Yard on Oct. 24. Chairman C. G. A. Rosen presented the report for the committee and Capt. L. F. Small, whose request made in a speech at an SAE meeting in Cleveland generated the project originally, accepted for the Navy. Other speakers at the informal presentation ceremony included SAE Secretary and General Manager John A. C. Warner and Lt.-Com. Carl J. Vogt, who brought a personal message from Capt. T. C. Reamy, USN. R. C. Sackett, secretary, SAE War Engineering Board, was toastmaster.

(See announcement on p. 74 of this issue.)

Capt. Small expressed the Navy's deep appreciation of the high value of the work achieved by the committee, while Mr. Rosen illustrated the intensity of SAE interest in the project by the fact that his committee has had 100% attendance at every meeting held since its organization.

The presentation ceremonies were preceded by a tour of the Norfolk Navy Yard.

A meeting of the committee with Navy representatives resulted in decision to continue the efforts of the committee actively on projects of interest to the Navy.

The report which the Navy received at the Norfolk ceremonies is one of several on which this committee is working and is one of the most important technical projects completed by an SAE group in recent years. Original objective of the committee, as requested by Capt. Small, was "to develop facilities to eliminate or reduce diesel engine torsional vibration problems to tolerable magnitude." He was eager to have developed "a standard means for obtaining uniformly acceptable and practically reproducible measure of stress due to torsional vibration."

Capt. Small envisioned five courses of action -- upon which the committee started its work:

1. Development of a simple and reliable torsiograph.
2. Development of a simple calibration device.
3. Provision of more information on dampers.
4. Securing of cooperation between engine engineers on torsional vibration problems.
5. Education of men in industry regarding this problem.

Committee Goals

Goals for the committee, either set up originally or developed as a result of committee deliberations, included:

1. Preparation of report on current practice in industry with regard to handling the torsional vibration problem.
2. Development of a standard torsional vibration data summary form for manufacturers to submit to governmental procurement agencies.
3. An investigation of shortcut methods for torsional calculation.
4. Development of a simplified torsiograph.
5. Development of a torsiograph calibrator.
6. Classification and specification of torsiographs.
7. An attempt through experimental readings to correlate test stand data with data obtained on board ship.
8. The rewriting of Navy torsional stress specifications.

The present status of each objective is reviewed in following paragraphs.

The report on current practice in industry with regard to handling the torsional vibration problem has been prepared for publication. This is the report delivered to the Navy at Norfolk.

The project for development of a standard torsional vibration data summary form for manufacturers to submit to governmental procurement agencies was started through a memorandum from Com. Den Hartog outlining a data summary form which he believes would, if used by manufacturers submitting bids on governmental contracts, simplify the work of those people in the government whose duty it was to evaluate such data. On June 2, 1944, F. P. Porter was appointed chairman of a subcommittee to prosecute this project. Under his leadership, the committee has prepared what it believes to be a usable version.

In June, 1944, L. F. Hope was appointed chairman of a subcommittee to investigate shortcut methods for torsional calculations. Various reports were made at subsequent committee meetings.

The need for a simplified torsiograph was initially voiced by Capt. Small, in the period just prior to the formation of the committee. It was decided, in furtherance of this objective, at the June 2, 1944, meeting in Detroit, to obtain for testing at the Navy Experiment Station in Annapolis two torsiographs of the simplified type. The two recommended by the committee were: (a) the General Motors mechanical torsiograph, and (b) the Chrysler optical torsiograph. These have been given to the Navy for testing.

Discussions with Navy personnel over a period of time indicated a lessened interest in "a continuously indicating simple torsiograph," but a definite interest in knowing more about the performance characteristics of torsiographs of all types. Thus Mr. Rosen's "Program of Testing" of Oct. 5, 1944, indicated the desirability of cooperating with the Navy on tests including other torsiographs in addition to the simplified torsiographs. At a Nov. 16 and 17 meeting in Peoria, L. M. Ball was appointed chairman of a subcommittee on the instrument test program in cooperation with the Navy. The test program finally decided on including all types of torsiographs (as well as available calibrators). Tests were actually run in Annapolis on March 12-16. At the April 27, 1945, meeting in Detroit a preliminary discussion of the test results was held. On June 7, S. T. Foresman sent a tabular review of the test amplitudes.

Development of a torsiograph calibrator was outlined by Capt. Small prior to the formation of the committee. As mentioned in his talk at Portsmouth, he has always been definitely concerned with instrument inconsistencies and inaccuracies. The general subject of calibration has assumed an important place in the committee's deliberations. From these discussions have resulted several published articles that directly concern calibrators and calibration.

At the Jan. 13 meeting in Detroit, it was decided that the tests at Annapolis scheduled for March 12-16 should include tests of the New York Navy Yard Sperry calibrator, the General Motors calibrator, and the Caterpillar calibrator. The calibrators were used at Annapolis and the results subsequently presented at the April 27, 1945, meeting in Detroit. At this time the committee believed it inadvisable to recommend any one calibrator to the Navy. On June 7, 1945, S. T. Foresman compiled remarks made concerning calibrators at the April 27

eeting. No subsequent action has been aken.

At the meeting in Detroit on June 2, 944, Mr. Ball was appointed chairman of special subcommittee to draw up specifica- ons of torsiographs to fall within three assifications designated by the committee: a) portable type for field use; (b) compre- ensive laboratory type; and (c) special ypes. Submitted reports and committee dis- ussion finally resulted in the completed orm shown in Mr. Ball's letter of May 15, 945. The suggested specification in this orm has been incorporated in the published eport.

At the Portsmouth meeting on July 18 nd 19, 1945, Capt. Small viewed with larm the apparent differences in torsional ibration amplitudes and stresses that exist n shipboard installations as compared to ngine test stand determinations. This re- ark led Mr. Rosen to suggest in his "Pro- ram of Testing" of Oct. 5, 1944, that the ommittee tests in cooperation with the Navy include experimental runs on the same ype of engine on the test stand and in- alled in a ship, the latter at various lengths f hours of service.

In a letter to Mr. Ball of April 16, 1945, Mr. Rosen mentioned that he was trying to nterest the Navy in providing a vessel for ommittee tests.

The rewriting of Navy torsional stress pecifications: The inspiration for this phase f the program derived from the talk pre- ented by Capt. Small in Portsmouth on "The Navy Specifies a Limiting Vibratory tress." This paper and the many aspects of he specification problem were discussed by he committee in Peoria, Nov. 16 and 17, 944. T. C. Van Degrift was appointed hairman of a Specifications Subcommittee. his committee was to prepare a report mbodying the suggestions advanced at this eeting. A subsequent meeting was held in Detroit on Jan. 11, 1945, and a report ritten. On Feb. 22, 1945, Mr. Van Degrift sked Capt. Reamy to present the Navy's iewpoint on specification revision. On larch 16, Capt. Reamy replied to Mr. Van Degrift with a letter written by Dr. E. C. Maedeburger.

■

Lubricity

cont. from p. 21

sphaltines formed by partial oxidation or artial cracking of the oil, Mr. Bauer said, auses more trouble. Contamination of this art is removed from the oil by a process known as *adsorption*. It employs certain lays, such as fuller's earth, which have a reater surface affinity for these unstable ydrocarbons than for the stable hydrocar- ons making up the oil itself. Clay blocks f these materials can be produced with ontrolled porosity and no harmful tendency o migrate. Proper proportioning of ab- orptive and adsorptive filtration can elimi- ate contamination of oil to a much greater egree than the limits specify.

With proper consideration given to prob- ms of design, application, and performance f continuous oil maintenance equipment, Mr. Bauer believes, startling results may be chieved in prolonging the life of machines, ncreasing their efficiency, and reducing aintenance.

Performance Counts In Postwar Vehicles

Digest of Paper
by

A. W. HERRINGTON
Marmon-Herrington Co., Inc.

■ Baltimore, Oct. 11

(Paper entitled "Automotive Transportation – Postwar")

NEXT year's automobiles may be quite similar to prewar models, according to Mr. Herrington. However, he believes that after a year or so of slightly embellished prewar styles, certain mechanical improvements will be ready for 1947. Indications point, he said, to elimination of the gear shift lever in favor of some sort of automatic transmission, and to adoption of independent wheel springing. In the main, postwar efforts will be directed, not toward any radical changes, but toward improving on the existing types in the direction of simplification, in order to facilitate mainte-

nance and reduce cost. The newer engines will probably be aircooled, Mr. Herrington believes, with the process based on methods used on armored vehicles during the war. For the export trade, production of diesel-powered passenger cars may be expected to accommodate unusual fuel situations in some foreign countries, although they probably will never be efficient enough to compete in the domestic market.

Prime requirements in trucks, Mr. Herrington pointed out, will be improved performance and more economical operation: the former to meet efficiency demands of shippers and highway authorities, and the latter to enable trucks to compete on an equal basis with other forms of transportation.

Buses, Mr. Herrington believes, have proved their efficiency by giving excellent service under severe handicaps during the war. New editions probably will have engines of the flat type for installation under the floor, and will use new safety fuels. Mr. Herrington predicts that the trolley will be used extensively, because of its economy, dependability, ease of acceleration, comparative lack of noise and odor, and dynamic braking.

Air transport will be considerably cheaper than before the war because of the great strides which have been made in aircraft engines during the past few years. Foreseeing great advances in the transport of perishable commodities by air, Mr. Herrington emphasized the responsibility of communities to provide adequate airport facilities to accommodate the air age.

■

Cost, Engine Design Retard Quality Fuels

Digest of a paper
by

ROY O. CAMPBELL
British American Oil Co. Ltd.

■ Canadian, Oct. 17

(Paper entitled "Quality Requirements of Modern Motor Fuels")

ONE of the principal problems retarding quality fuel development at the present time, Mr. Campbell believes, is the fact that engine development has not kept up with fuel development. The situation is paradoxical, he said, because the fuels are too expensive to use until proper engine design enables them to be produced in large quantity, and at the same time there is no incentive for distributing higher performance engines to consumers until fuels which will meet their performance requirements are available for general distribution. A partial cause of the situation, he explained, is that during the war the petroleum industry was given financial carte blanche in the development and manufacture of super fuels for aircraft engines, so that there is now a backlog of experience and technique much in advance of engine development.

Since antiknock value is the most important single factor determining engine performance, Mr. Campbell said, fuels are graded for quality on the basis of an octane number, which expresses antiknock value. Knock probably is due to violent explosion of unburned vapor-air mixture, which is critically heated and compressed by progressive burning of fuel in the cylinder head. Results, he said, are loss of power, overheating, and possibly cracking of pistons, blowing of head gaskets and destruction of connecting-rod bearings.

Standardized tests for octane number made on CFR testing unit engines, according to Mr. Campbell, show clearly whether or not fuels are adequate to the requirements of cars actually on the highways. The engine used is a nonsupercharged single-cylinder engine with a continuously variable cylinder head which allows changes of compression ratio during testing. Close control is maintained of speed, temperature, mixture ratio, and intake air humidity. Research test procedure employs a knockmeter to measure knock intensity, while Motor test procedure compares actual die-out points under acceleration of new fuels with other known fuels to determine octane number.

Another test described by Mr. Campbell as particularly useful for fuel research and providing engine designers with information is the borderline knock method. In this test, the engine is accelerated several

times, with the spark slightly advanced in each successive trial. The die-out points in each acceleration form a curve which is the dividing line between knocking and nonknocking operation. Compared with the known automatic spark advance curve for the test engine, Mr. Campbell explained, this curve will show speeds at which knocking will occur, and also how much spark advance could be built into the automatic distributor to make better use of the potentialities of certain fuels.

Since low speed knock seems to be the worst offender, and it is difficult, according to Mr. Campbell, to train motorists to stay in second gear up to 30 mph, much effort has been directed toward improvements in engine design and fuels which will help to eliminate the evil. Among these are better manifold design, including dual carburetion and higher intake manifold heating; use of superchargers as a means of reducing the octane-number requirement; production of more volatile winter fuels, and more olefinic composition of the low boiling fractions of of the fuels. Beyond this, he said, little can be done, short of entering the realm of high cost fuel manufacture.

Hopeful aspects of the problem, according to Mr. Campbell, are the fact that passenger-car manufacturers have so far closely followed increases in motor fuel quality with better engine performance, and that there are sufficient good production processes already developed to meet the need for super fuels when it arises. He is certain that close cooperation between development engineers of the petroleum and automotive industries will hasten the development of compatible fuels and engines to run future automobiles.

■

Farm Time and Labor Saved by Hydraulics

Digest of a paper

by L. R. TWYMAN
Vickers, Inc.

■ Milwaukee, Sept. 13

(Paper entitled "Hydraulics as Applied to Tractors and Farm Machinery")

THE application of hydraulics to farm machinery will have the extremely important effect of equating to a large extent the physical capacity of the farmer with the productive capacity of his tractor-implement combination, according to Mr. Twyman. Since the biggest barrier to full utilization of farm machinery has been the limitation of human strength, he said, the contribution of hydraulics in saving man hours, conserving muscular energy and adding to machine efficiency will be a major one. Because of the strict cost limitations connected with all farm machinery, he pointed out, prompt progress in the standardization of hydraulic equipment is especially important.

Mr. Twyman described the hydraulic control system as consisting essentially of a pump, a small control valve and a fluid motor. The function of the pump is to convert the engine's rotary mechanical power into hydraulic power, more sensitive and more universally useful, which is in turn converted under pressure into linear or rotary mechanical power, at the place and force desired, by the fluid motor.

Among the numerous advantages of hydraulic control discussed by Mr. Twyman are:

1. Absence of exposed belts, chains, gearing shafts, bearings, clutches, and other troublesome and dangerous parts, so that safety shields are unnecessary.
2. Elimination of space interferences and many lubrication problems.
3. Solution of the problem of getting power around corners.
4. Possibility of delivering a given torque at varying speeds by varying the amount of oil transmitted to the fluid motor, either through the displacement rate of the pump or by valving in the intermediate system.
5. Provision for automatic overload protection in the case of abnormal obstruction to movement.
6. Inherent lubrication.

To the farmer himself, Mr. Twyman pointed out, this means not only that the effort required for normal operations will be reduced to the manipulation of levers, but also that eventually many of the jobs

of adjustment, for instance to changes in land contour or soil consistency, will be taken care of automatically.

Hydraulic application has failed to find universal acceptance in the farm machinery field, Mr. Twyman believes, chiefly because of the expense occasioned by lack of standardization in mounting and drive equipment, and also because engineering application work has not yet been extensive enough to apply hydraulic power to all the farm tasks for which it is fitted. In this connection, he pointed out, there are certain important aspects of pumps, valves and fluid motors which must be taken into account. Pump design should take into consideration intermittent pressure, volumetric efficiency, drive speed, delivery rate, viscosity range of the hydraulic oil being pumped, and ease of field servicing. Important characteristics of valves, or directional controls, are flow capacity, controllability, smooth starting or interruption of oil flow, and minimum leakage. Fluid motors involve most of the same considerations as pumps, especially volumetric efficiency, and also stalled, starting, and running torque ratings. Proper design of hose connections, filter, sealing methods and other accessory parts is also important.

Among the general problems of application engineering still to be met, with the factor of cost always taken into consideration, are the manner of mounting and driving the single or double hydraulic pump . . . mounting of large pumps at the front end of the crankshaft, he believes, is about the best location; the choice between the simplicity and lack of exposed parts of a grouped hydraulic system and the flexibility and convenience of separate units, and the problem of designing rotary fluid mountings to provide for interchangeability of implements.

In conclusion, Mr. Twyman again emphasized the inherent flexibility of the hydraulic method of power transmission and control, its applicability to any type of power driven farm machinery which can use the tractor as its source of power, and the overall importance of providing soon for coordination between tractor and implement to remove the burden from the farmer.

CARS and MEN

cont. from p. 18

The cooling was remarkably good as illustrated by the fact that he built three racing cars for the 1906 Vanderbilt Cup Race, with 7¼ in. bore and 4¾ in. stroke. These engines were 4 cyl.

Considering the crude mechanicss available in those days, they cooled remarkably well. I believe it is a safe statement that this early development clearly blazed the pathway for the present efficient aeronautical aircooled engines.

There were a number of two-cycle cars in those early days, all of which points out how broad the field was in which the designer had to choose his pathway.

Permit me for a moment to refer to some of the men who built those early cars and who contributed so much in laying the foundation stones for this industry. They were Frank and Charles Duryea, R. E. Olds, Elwood Haynes, a great early metallurgist, the Apperson brothers, Henry Ford, Henry Leland, John Wilkenson, the designer of the Franklin, Al Brush, Charles King, Alexander Winton, Harry Knox, Lee Frayer and a host of others too numerous to mention.

About this time another type began to evolve. Let us call it the typically foreign type. In a general way it is our automobile of today, and if one describes the early Mercedes, he would generally cover them all. These cars had four-cylinder engines located forward, radiator vertical in front, pressed steel frames and transmissions with progressive or selective gears, three or four speeds, forward and reverse, located amidshifts, separated from the engine case, and right hand steering. There was a great deal of controversy as to the final drive, however. Renault had just introduced the bevel gear or cardan shaft drive and some other makers were beginning to follow, but Mercedes continued to use the double chain. The argument as to the value of the final drive was not settled until years later. I believe our old friend Henry Crane, a past-president of the SAE and father of the Simplex of those early days, was one of the last to leave

ic double chain drive. One of the advantages of the double chain drive was the ight underspring weight of the rear axle. The front axles were of "I" beam or tubular onstruction.

One of the nicest problems in those early ays was the ignition. It was usually a high ension system with four trembler or vibrator coils located on the dash and from there, our high tension leads went to the spark lugs. There was a primary breaker that istributed the current to the primaries of he coils. You can readily see the proper djustment of these vibrators which affected he timing of the cylinders, together with he adjustment of the inlet valve spring, equired a pretty nice piece of expertness. number of the prominent foreign cars ill used the make-and-break system which as merely a mechanical method of opening lectrical contacts inside the cylinders and his system was usually operated by low ension magneto.

I am not going to attempt to follow the evelopment of the ignition systems through he stages of high tension magneto or single oils with high tension commutator to the resent splendid systems, except to say this evelopment brought into the industry one f its most dominant and colorful as well s useful figures. I refer to C. F. Kettering. Many of you lived through that era, but I would like to call your attention to the many causes of discussion and argument in hose early days. Salesmen were in a quandary to explain these differences. I can remember one well-known salesman of foreign cars in New York who, when asked by prospective customer to explain the difference between low tension and high tension ignition, asked the customer, "Are you n electrical engineer?" and when the man esponded that he was not, the salesman aid, "Well, there is no reason my explaining it to you as you would not understand anyhow."

Early Use of Aluminum

Invariably the engine crank cases and ransmission cases of those early cars were luminum castings. The cylinders of cast on were cast either singly or in pairs, and here was a great deal of controversy as to oundry practice. A few of the cars, notably ackard and Peerless, imported their castings from the famous Plichon Foundry in rance, as in those early days we really did ot know how to do fine core work and make thin walls, as well as other castings.

There was a great deal of prevarication bout the weight of those early cars. The heelbase ranged to somewhere between 00 and 115 in., and apparently everybody as trying to hold the car to 2500 lb of eight, and practically nobody would admit hat his car weighed more than that.

When you consider the relatively flimsy res of those days, you can readily see that eight was an important point and there as just about as much misrepresentation, shall we say lying, about the weight of ars as there was later about speeds and asoline consumption.

There was much discussion about lubrication of these cars. The crankcase that had eed speed lubrication was considered ra-modern. This usually consisted of a ubricator mounted on the dash, driven by silent chain or belt with individual pumps hat forced oil into the bearings and cylinders, and then we began to hear the word splash" lubrication which simply meant hat the connecting rods were dipped in an oil bath. The simplest form, of course, was gravity feed lubrication from the dash and you can see the adjustment of all these things had a considerable influence on the smoking and running of these earlier cars.

Typical examples of this foreign type of automobile in the early 1900's were the Apperson, the Walter – made in New York, the Columbia – made by the Electric Vehicle Co., the Locomobile, Peerless, Packard, Pope-Toledo, the Great Arrow (which was the Pierce of later days), the Stearns, the Thomas Flyer and later the Lozier and the Dorris.

These cars were really beautiful examples of early independent thinking. There were very few guide-posts and no public mechanical consciousness. The American public had to be taught both its mechanics and its style taste. It was about this time that we evolved from the rear entrance tonneau to the side entrance type. There were great independent body builders both in Europe and America with very little coordination and cooperation by the coach builder and the automobile designer. As a matter of fact, there was considerable conflict between them but this conflict evolved certain definite types which had their public appeal and which eventually dominated.

Now this early period might well be called the rule of thumb stage. There was

practically no such thing as a dynamometer. A few engines were tested on belt-driven dynamos. The manograph was a big theory which was just coming into use and practically all experimenting and testing was done on the roads under actual driving conditions and usually done by the designer and the climax of these tests was the races, endurance runs, hill climbs, economy tests, and other forms of early contests. You must understand in those days the effort was to make the public conscious that these automobiles would run and to create confidence in their reliability. As a sample of these early promotional contests, in conjunction with a foreign driver, I drove a French Clement-Bayard in a six-day-and-night endurance test in 1904 to an alleged world's record – and the following year Lee Frayer and I drove a Frayer-Miller four-cylinder aircooled car in a six-day-and-night race on a road course from Seabright to Sea Girt, New Jersey. There were some ten contestants in this race and we actually covered 3202 miles in 148 hours and made a nonstop record of about 1800 miles. We were hailed as the world's long distance champions. I still have as a prized memento a gold medal presented to me by Senator Morgan for that run.

There was no knowledge of metallurgy in those days. Most of those hardy pioneers were graduates of the bicycle or carriage business. Heat treating was unknown and only the really true experts understood carbonizing – or case hardening, as it was called. Selectivity of steels was unheard of. The most usual method of hardening was heating and water quenching. Nickel steel was only a mysterious word heard from across the ocean and vanadium was not even heard of, but in those alloys was the greatest advantage of the early foreign cars. Europeans had steels and knew how to use them. Tolerances, as we know them today, were unknown because we had no experience as to what these should be.

Starting around 1902, slowly but surely the foreign type of automobile began to displace the typically American types one by one. Engines came forward and became vertical. Slowly but surely the many trick transmissions, such as friction drive, the planetary, and other types began to disappear and it became difficult to pick out the actual foreign car from the American car. Styling began to appear.

Techniques Improved

Experimental departments were started and experimental equipment came on the horizon. Technology began to displace the crude guesswork of the earlier days. Ignition and carburetion began the stages of standardization as we know it today. These were the cars of 1904 to 1909. They took on a sheen of their own. They were not standardized in either mechanics or style but they were true shadows of the men who created them. And what men they were! Louis Mooers, chief engineer of the early Peerless and Moon cars; Charlie Schmidt, the first crack foreign engineer to come to America to design the first four-cylinder Packard and later the Peerless; Bob Jardine of the Royal Tourist; Pop Grueter, designer of the first Grueter and later the Mathewson; Ted Finch, designer of a very beautiful car, the Pungs-Finch, made in Detroit; Howard Marmon, who I believe was the first engineer to use effective pressure oiling systems; Col. William Guy Wall of the National; George Weidley of the Premier; Col. Herbert Alden, designer of the early Columbia, and later the engineering chief of the Timken Axle Co.; Elmer and Edgar Apperson; Al Brush; George Dorris, who built perhaps the first unit powerplant in America; A. L. Riker, the designer of the early Locomobiles and first president of the SAE – all these men had great influence on those early designs and there were others too numerous to mention. These men left their mark on this great industry, some vaguely it is true, but nonetheless definitely, as each contributed a stone in the foundations of this industry. These men had strong convictions and often risked their entire fortunes and professional futures on their individual judgments. They had no hewn paths to follow, no elaborate laboratories to prove or disprove their theories and most often their experimental laboratory was the owner – and unlike the doctor of medicine, they couldn't always bury their mistakes. They had no textbooks to refer to, but in lieu of technical literature there was a tremendous lot of individual thinking going on.

Since 1909 the influence of the Society of Automotive Engineers has been felt, although the Society was founded four years earlier, and these great engineers began to be welded into a unit that is still unique in technological societies. The summer meet-

gs were a wonderful thing in those early ys and these men learned to become iends although they were business rivals. hey freely and willingly exchanged views nd ideas. Their experimental rooms were, ith rare exceptions, open to each other and don't hesitate to say that some of my osest friends of today were the acquaintnces I made in those early days among en who were my competitors of thirty and rty years ago.

About 1909, a very important event took lace which, I think, had tremendous influnce on the future of the SAE. The activies of the mechanical branch of the Assoation of Licensed Automobile Manufacturrs was transferred to the SAE. This great ork was initiated by H. M. Swetland, one f the founders of SAE; Coker F. Clarkson, en manager of ALAM's mechanical branch nd later the first general manager of the AE; and Howard Coffin, SAE president in 910.

Originally, ALAM had its own mechanial branch to disseminate mechanical and chnical developments – but barred all nonembers from participation. The ALAM eliberations had a cloak of secrecy which ould make diplomatic sessions blush, but ith the broad viewpoint laid down by SAE aders following the transfer and supported y Alfred Reeves, then ALAM general manger, secrecy was discarded, and SAE began o carry on a broad, cooperative technical rogram which for years received a finanial grant from the ALAM and later from s successors, the National Automobile hamber of Commerce and the present utomobile Manufacturers Association. Peronally, I feel that this wider viewpoint had uch to do with making possible the ross-licensing agreement among ALAM anufacturers, which, to my mind, was a agnificent accomplishment in industrial ooperation and which did much to clear up he early patent confusions which appeared or a time likely to throttle mechanical rogress.

It is a long jump from these early develpments to 1945, which, I would remind ou, is the 40th Anniversary of the foundng of your Society of Automotive Engiieers. I am proud, indeed, to be one of its arly members. You and I can take great ride in the contributions of this great Soiety to the mechanical progress of the ndustry through more than four decades, n its major accomplishments during World War I and in its even more vital achievements during the trying years of motorized war which threatened our civilization durng the past four and one-half years.

In conclusion, just a few words on the ossibilities of the future that lie before you ounger men.

I am sincerely convinced that at no time n the history of the industry was there reater opportunity for real mechanical adancement and progress than there is today. The field was never so open nor the problems o varied – nor was there ever a time when he technologists had the tools to work with hat they have now. Just consider for a moment the powerplant. C. F. Kettering as unfolded the story of triptane. This eans engines of double the mean effective pressure and almost double fuel mileage. William B. Stout speaks of built-up crankshafts and solid connecting rod big ends. William S. James and the rest of the Ford group tell of cast crankshafts – and I can tell you it's perfectly simple and feasible to make crankshafts of small fairly well balanced sections and weld them together. Then you have the fabricated steel engine and transmission cases. These are clearly indicated. That means light-weight and improved thermal conditions. Then there is turbine development. No one can foretell where that will end.

Clutches and transmissions are going through tremendous changes. The surface isn't even scratched. Consider the discussions on location of the engine – front, rear or middle, and don't ignore the middle. The Auto-Union racing car was one of the finest examples of this I'd ever seen and the flat engines open the gateway to that form. Spring suspensions are wide open, as you well know, and this country hasn't even started on the complete four-wheel independently sprung car. The finest riding car I ever drove was of that type. Brakes, I believe, offer the greatest opportunity for improvement. Smaller wheels, larger tires and the restricted spaces will force some very nice brake designing, and just to throw in a thought, consider the coaster brake on a bicycle. It is 3/10 in. wide, 2 in. in diameter, and yet is the only means of stopping a bicycle. The accessories of various types offer a tremendous field and I particularly call attention to the development of direct fuel injection.

These are only high spots. I think I could point out twenty more fields for develop-

ment so don't for a moment feel that the end of the trail is here. You haven't even started, but the price of success will be higher than ever before and you must pay in work, study and research. You will have to put in more effort, but your take-out will be proportionately greater, so don't cry for the good old days. Keep your courage high and the motor car 10 years hence will be as much changed and improved as the car of today is over those that I described this evening.

F & L

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testing equipment, education of operating personnel, and the development of reference fuels and lubricants.

Lifting of military restrictions permitted announcement that during the war CRC groups had worked with the military in analyzing fuels and lubricants taken [illegible] Nazi equipment. In one case, it was [illegible] samples of crankcase oil were flown to [illegible] country and analyzed, findings reported [illegible] British military intelligence, and the [illegible] man refinery producing the oil bombed [illegible] destruction – all within five days.

Illustrative of progress in developing [illegible] factory testing equipment was described [illegible] apparatus for testing wheel-bearing [illegible] Objective, it was explained, was to [illegible] mine the nature of greases displaying [illegible] mum tendencies to leak or to migrate [illegible] ing 6-hr tests. Sixteen test machines originally were built, and 25 more [illegible] are under construction. Operation in different laboratories was said to have proved [illegible] only that results are comparable, but [illegible] it now should be possible to produce greases which neither leak nor migrate. As a result of the cooperation of industry and military in developing grease tests and equipment, it was added, grease manufacturers can produce greases which will meet required needs, and, by test, eliminate [illegible] varieties which have poor service characteristics.

New Lubricants Reported

Development of silicone fluid and grease lubricants characterized by high resistance to heat, cold, and oxidation was reported to meet the need, particularly of aircraft equipment, for lubrication of moving parts throughout extreme temperature ranges. Silicone greases and compounds, it was explained, resist changes in consistency over a temperature range of —40 F to 400 F.

Some silicone fluids were said to have pour points of —50 F to —96 F. It was reported that if the temperature of a silicone fluid and of a petroleum fluid, each having the same viscosity at 100 F, is reduced to zero, the silicone fluid will have only one-sixth the viscosity of the oil.

The silicones were characterized as "perfect lubricants" in so far as heat stability, oxidation resistance, and general chemical inertness are concerned, but were said to lack the overall lubricating qualities of petroleum oils. Lubricity was reported to vary extreme variations, not only between fluid but between metals and loads.

The silicone fluid DC-710 was reported to lubricate as well as SAE 20 for many purposes, surpassing petroleum oils in steel-to-brass lubrication at moderate loads but proving less effective at loads approaching extreme-pressure ranges. Opinion was expressed that the silicones will have a wide range of applications as lubricants, especially when loads are light to moderate, temperature changes rapid or extreme, and oxidation dangers high.

It was said that the silicones combine the flexibility and solubility of pure organic materials with the stability of the inorganics and have demonstrated an insolubility in water which suggests the possibility of specialized applications to solve difficult lubricating problems. Silicones were described as products of coal, brine, sand, and [illegible] with manufacture from natural gas a possibility. Compounding with extreme-pressure additives was cited as another possibility of continued research. Present cost was quoted as $6.50 per lb.

Diesel Progress

Progress in development of diesel engines and fuels, so rapid as to demand new concepts of fuels and lubricants needs, as well as of diesel-engine performance, was characterized as heralding the obsolescence

the diesel index and cetane number. It was said that theoretically perfect 100-cetane diesel fuel, already produced in the laboratory, can be made commercially available when, as, and if desired.

Question was raised as to need for any too great concern either for cetane number or diesel index in view of the greater need for research in diesel fuels, lubricants, and engines looking to development of a combination which will produce maximum power at minimum cost. Discussers advocated diesel fuel, lubricant, and engine research purely in terms of ultimate operating performance, and remarked that captured equipment has indicated that German diesel fuel was at least a year ahead of American. It was proposed that wartime cooperative work of designers and users of diesel fuels, lubricants, and engines be continued, and that more attention be paid to basic research in combustion.

Seek Data On Combustion

Present tests and indexes of diesel fuel volatility and ignition qualities were described as helpful, but the greater need was said to be exact knowledge of burning qualities, or combustion. Cetane ratings were said to have no relationship to combustion, although high-cetane fuels were reported to have easy-starting qualities which facilitate the use of low-combustion engines.

Tests with railroad switching locomotives, in which amyl nitrate additives were reported to have demonstrated the possibilities of obtaining engine performance so superior as to require new concepts of power production. It was explained that the addition of a small quantity of amyl nitrate to diesel fuel of 44 cetane number resulted in producing the same power output per gallon per hour as 50 cetane untreated fuel.

Discussers questioned whether such results with diesel engines in railroad switching locomotives might be considered as applicable to high-output diesels, and declared that the inherent thermal efficiency of the diesel engine is more important than the nature or the cost of the fuel it consumes. It was explained that the trend appeared to be toward lower compression in diesels, higher compression in gasoline engines, and while there are indications that the two may meet at a point near 11 to 1, with 90-cetane diesel fuel available for the one and 90-octane gasoline for the other, there is a real question as to whether the greater advantages are to be found in high-cetane and high-octane fuels.

Proposal was made that the cetane number properly be viewed merely as an indication of a fuel's starting qualities, and that fundamental knowledge be sought as to the best type of fuel to produce the maximum performance from each type of diesel. The need for pure hydrocarbons to aid such research was stressed.

Additive fuels were said to have created new concepts of performance when used in supercharged diesels built for the U. S. Navy. Belief was expressed that modern refineries can produce diesel fuels of special composition for special engines and jobs.

Jet Propulsion Developing

Jet propulsion for aircraft was described as having extreme advantages in high speed and thrust, and as becoming most efficient at speeds above 400 mph and at altitudes above 30,000 ft, where propellers lose their efficiency. Fuel consumption was said to be excessive only at low speeds and altitudes. Substantial advantages were reported to be found in simplicity of design, immediate operation with no warm-up at temperatures of —40 F, ease and economy of manufacture, lightness, and absence of vibration. Efficiency of jet propulsion, it was said, would be increased as soon as metallurgical progress permits of operation at temperatures around 2500 F instead of the present 1200 to 1300, and better-suited fuels become available.

Jet propulsion was said to be unsuited to propulsion of ground vehicles except through adaptation of the turbine. It was predicted that a combination of jet and rocket propulsion eventually might make it possible to operate aircraft at several times the speed of sound.

It was admitted that jet propulsion is so new of application as to lack adequate background of research and development. Tremendous fuel consumption was characterized as a current handicap. While the latest large-size jet-propelled ship is capable of flying nonstop across the United States, it must take aboard a full tank car of fuel.

Lubricants for jet-propelled planes were described as being stable in storage at —80 F, resistant to oxidation at higher than 200 F, and to be made by compounding California base stocks with additives.

APPLICATIONS Received

The applications for membership received between Oct. 10, 1945, and Nov. 10, 1945, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Robert Fuller Birdsall, Herbert Logan Spencer.

Buffalo Section: Rolly W. Fitch, Philip C. Rapp, Howard C. Jones, John T. Mitten, R. Theodore Whittleton, Carl T. Woznicki, William A. Zech.

Canadian Section: Charles P. Archibald, Charles Carter, John Gelb, D. Ray Hornell, Rolland Lewis Jerry, J. W. Primeau, Stanley John Randall.

Chicago Section: Hiralal Sitaldas Dalal, Kenneth William Gehrke, Joseph Gregory Green, Jack Louthan, Parmer Bruce Maxwell, Harry Role, Arthur Folsom Weston, Richard Wysock.

Cincinnati Section: Robert H. Jahnke, Paul Klotsch, Charles A. Simpson.

Cleveland Section: Frank J. Barina, Carl E. Bricker, Trevor Fink, Robert D. Fisher, Jr., Donald F. Horsburgh, Gilbert J. Monigold, Robert D. Pae, Burton Scheiman, Arthur E. Stevens, Robert William Titgemeyer, Oscar F. Welshans.

Colorado Group: Major Ronald Mogford.

Dayton Section: Donald Dunham Herman, Norman K. Reinhard, H. G. Spier.

Detroit Section: Joseph Steven Alan, J. Robert Arnold, Joseph Charles Brabetz, Robert P. Clifton, Robert T. Curchuru, N. B. Dicken, Manuel H. Elkin, Capt. Ross Lauder Fryer, Jr., J. B. Gates, Ludwig A. Gribler, John R. Harder, Levi Lithgow Henry, Thomas L. Holbrook, Sr., Sidney E. Hotchkiss, Lee C. Jenne, Edward Zenas Jessop, Melville D. Johnson, William F. Knouff, Frank D. Leonard, Harvey G. Moore, Jr., George Andrew Rives, Fred L. Sage, Jr., Capt. James A. Scobie, Jr., George L. Smith, Eugene Tapperd, Baxter Webb, Fred E. Williams, John R. Woodside.

Hawaiian Section: Charles A. Harker, Lewis M. Hubbard, Lloyd Dean Larson, James Alexander Malloy, Eugene George McKibben, Robert L. Muller.

Indiana Section: Floyd James Boyer, John Jacob Gambold, Harold Hale Hall.

Kansas City Section: P. T. Naudet.

Metropolitan Section: Arthur John Bennett, Gustave David Cerf, Eldred R. Crow, Charles S. Davis, Jr., Charles L. Ginocchio, Ens. Norton B. Jamieson, J. Van R. Kelly, Joseph E. Knight, Leigh R. Lydecker, John Everett Plantinga, Robert Puiseux, Myron W. Sawmiller, Allen Shaw.

Mid-Continent Section: Cornelius H. Blase, George F. Racette.

Milwaukee Section: Elmer Edward Croisant, Donald E. Lewis.

Mohawk-Hudson Group: Maurice J. Collins, John F. FitzGerald, C. L. Lovercheck.

New England Section: William James Gaugh, John Alfred Stern, Harry E. Williams.

Northern California Section: John W. Eaton, William R. Hodge, Nathan David Jacobson, John R. Lambrecht, Robert J. Rice, Cloyd C. Smith, Harold D. Stromberg, George W. Walker, Jr., Robert George Whitney, Clarence W. Winther.

Northwest Section: Chester F. Coleman, William O. Harper, Walter N. Jamieson.

Oregon Section: Scott Chandler, Ens. Erland Victor Hill.

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NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between Oct. 10, 1945, and Nov. 10, 1945.
The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: Lt. W. Henke (J), Randolph Stewart Merritt (A).

Buffalo Section: Harold P. Henderson (A).

Canadian Section: R. Norman Grainger (A), Malcolm P. Jolley (M), Albert Jude (M), Chester Van Wagner (A), Ralph P. Warriner (A).

Chicago Section: Ralph C. Archer (M), Forrest M. Barney (J), Harry Cornell Dennin (M), Wm. J. Du Pilka (A), Carl Hattermann (M), Lawrence R. Lyons (M), Nicholas Zasiebida (A), Chet A. Zielin (A).

Cleveland Section: Robert H. Davies (M), Preston G. Edward (M), Walter L. Morris (M).

Colorado Group: Jack P. Shoup (J).

Dayton Section: Richard E. Gould (M).

Detroit Section: Ernest V. Bunting (M), Orville Craig Fay (J), Matthew E. Hamilton (M), Kenneth L. Hulsing (M), Neil M. Hurry (A), William H. Kieber (M), Wade Lamb (M), A. F. Lapp (A), George Paul Loweke (M), Michael Marvosh (M), Edward W. McIntosh (A), Glennard L. Olson (M).

Hawaiian Section: Clyde H. Ahlf (M), Howard L. Overman (A).

Indiana Section: H. W. Dietrich (M), Donald G. Zimmerman (J).

Metropolitan Section: Jacques A. Antouet (A), George C. Fowler (A), Arthur L. Denny (A), John C. Gibb (M), W. Kenneth Houpt (J), Edward H. Jacobs (J), John H. Middlekamp (A), Arthur Poltmann (M), Jacob Carl Rubin (J), Wallace M. Sinclair (J), Mildred E. Suran (J).

Milwaukee Section: Darryl W. Johnson (M), Lt. Wilson B. Riggan (A), William John Sanderson (M).

New England Section: John Bouwhuis Chester (J).

Northern California Section: Lt. (jg) Robert Laurance Bennett (J), Allan P. Jones (A).

Northwest Section: John E. Allan (A), Robert Harold Shaffer (M).

Oregon Section: L. A. Christensen (A), Jesse M. Roseberry (A), Robert W. Westcott (A).

Peoria Section: Harold F. Stenstrom (A).

Philadelphia Section: W. Newlin Keen (J).

Pittsburgh Section: Charles Roberts (M).

Southern California Section: John K. Brinkman (J), W. L. Craven (M), Joseph C. Gill (A), Robert Gordon (J), Stanley T. Horn (J), Lawrence W. Johnson (J), John Wm. Kelly (J), William H. Koehler (J), William Albert Lester (J), Dwight M. Moore (M), Rollin K. Reiss (M), Chandler C. Ross (M), John A. Ruthven (A), Nicholas J. Salters (A), Fred H. Squires (M), Joseph O. Strong (A), Zargous Zoraster (A).

Southern New England: Lawrence R. Ferry (J), Alexander M. Watson (J).

Texas Section: Frederick Franklin Bell, Jr. (SM).

Twin City Group: C. P. Rosenberger (A), John O. Tews (A).

Virginia Group: Capt. William Loy Groth (A), James A. Kline, Jr. (A), J. D. Lawrence, Jr. (A), Leroy E. Marlowe (A), Henry P. Mitchell (A).

Washington Section: Melville Lawson Brown (SM).

Outside of Section Territory: Albert William Allbright (A), R. G. De La Mater (M), John G. Houston (M), Horace D. Taylor (J), John Doane Wicks (A).

Foreign: Albert Edward Hope (FM), England; Jurij Koffman (FM), England; George Henry Olding (FM), Australia; Edward Francis Perry (FM), England; William Collin Spouse (A), Victoria, B. C.; Glynnden Jack Sinclair (J), Australia.

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Applications Received

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Peoria Section: John G. Findeisen, Thomas M. Logan.

Philadelphia Section: Charles Oscar Bird, Edward Edmunds, John P. Landis.

Southern California Section: William K. Bowman, James Frederick Cook, Presley C. Dawson, Philip M. Hensley, A. E. Isham, Yuan C. Lee, Oren V. Roberts, A. Virginia Rowley, Waldo A. Runner, J. H. Severson, Mary Sherry, Austin Graham Silvester, Walter Van Voorhees.

Southern New England Section: John Boyle Cray, Russell M. Lipes, Jr., Lt. Jacob William Parks, Herbert E. Pike.

Syracuse Section: Israel Katz.

Virginia Group: Richard L. Smith.

Washington Section: Roland Howard Gapp, Major William A. Howe, Lt.-Com. Julius Kendall, Lt. Charles L. Seelbach, Walter H. White.

Western Michigan Section: John T. Derrickson.

Wichita Section: Donald E. Jarman.

Outside of Section Territory: Dwight Moody Dellinger, John T. Eberline, Lorne W. Hamilton, Toivo W. Huurto, J. Brent Malin, John M. McCollister, Edouard Morris, Boris M. Osojnak, David Lewis Rutter, Herbert Hiram Thurston, Major Lian-Tong Wen.

Foreign: Major Charles Edward Day, England; John Jameson Edgar Gill, South Africa; Douglas Charles Neaves, England; Clarence Frank Nossiter, England; Alexander Robert Ogston, England; John William Warrington, England.

Aero

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acceleration to the fluid in the tube lines. Howard Field, Jr., in discussing Mr. Loweke's paper pointed out that the ideal brake valve would have perfectly smooth control of brake action. It would have an infinite number of infinitesimal increments in the pressure versus control motion curve. This is almost achieved in the manual brake systems used in automobiles and small aircraft but no power brake valve of any type approaches this idea, because definite increments are present. If the pilot is to have good control it is important that these increments be as small in magnitude and as large in number as possible. This is doubly important when the brakes are very powerful or when the geometry of the landing gear makes steering unusually easy, Mr. Field said. Thus any brake valve, and especially an unbalanced valve, must be very carefully designed and the unbalanced area kept small or the net result will be a brake which allows the pilot little discrimination.

The equation $L \times d^5 = D^5 d$ is interesting and valuable but he thought it of little significance in the particular application. Mr. Loweke seemed to have presented it to help designers keep the line losses upstream and downstream from the valve the same, Mr. Field suggested. It might lead to uneconomical design from the weight standpoint in many cases.

Mr. Field pointed out that the ideal brake would have zero lag, which is impossible. Probably the best possible brake would have a lag less than the reaction time of the pilot, but even this may be impracticable from a weight standpoint. "However," he said, "we are somewhat skeptical about 1½ sec being a short enough lag to be adequately safe for commercial transport operation. For this reason we do not believe that a lag of 1½ sec, a Reynolds number of 5000, and a fluid velocity of 35 ft per sec is a general case but rather a particular case. The unthinking use of these criteria may prove dangerous."

He believed that the rate of flow should be made as large as possible within practicable weight limitations so that brake lag will be as small as possible. He recalled that an airplane moving 100 mph will travel about 220 ft in 1½ sec.

Incidentally he found that electrical strain gages in a Wheatstone bridge arrangement make a nearly perfect pressure pick-up. Since the resonant frequency of the complete pick-up may be on the order of 50,000 cycles per second, transient phenomena are readily measured. "If we wish to standardize on test methods so that results from different laboratories may be correlated it would seem foolish to choose methods having large known inaccuracies," he said.

Under the chairmanship of Mac Short, SAE past-president, the afternoon Air Transport Session heard papers on Economics of Airline Fuel Utilization by W. V. Hanley and A. Hundere, California Research Corp., and Cruising Economy by Use of Water Injection by D. C. Eaton, Wright Aeronautical Corp. Extensive discussion followed this session.

Considering the economics of airline fuel

utilization, Mr. Hanley emphasized the importance of cooperative effort on the part of engine, air frame and fuel manufacturers and airline operators in solving specific problems such as the economic value of antiknock quality in fuels for airline use.

High-Quality Fuels Advantageous

The advantage of using higher quality and more expensive fuels does not depend only on the ratio of price spent to cost saved, he said, but is determined by such important details as landing weight limitations laid down by the CAA. For a given operation, these mean that in order to utilize the full load carrying ability of a plane, sufficient fuel must be consumed to reduce the gross take-off weight to the permissible landing weight. On short range flights, those which are short of the landing weight limited distance, he said, it is impossible to utilize the full load carrying capacity of the airplane, since the payload is not affected by changes in fuel consumption.

On long range flights, greater than the landing weight limited distance, the full load carrying ability is utilized by take-off at maximum allowable gross weight. Here the payload is a function of the flight distance, and affected by variations in fuel consumption. The payload is always decreased, of course, by the amount of reserve fuel carried, and present Civil Air Regulations require sufficient fuel for flight to destination, plus distance to the alternate landing point, plus 45 minutes' flying time. These facts are important from the standpoint of fuel quality, since high quality fuels are usually valuable only for long-range flights, when they permit higher compression ratios with a resulting reduction in fuel consumption.

In a prepared paper, Andrew L. Pomeroy, Ranger Aircraft Engines, hoped that demand for, and development of better quality fuels will not be discouraged. Engines can be designed, and are available, he said, which will show greater returns for increase in antiknock quality than the one cited by Mr. Hanley. It is not uncommon, he said, with an engine of fixed displacement to increase the take-off power approximately 18% by using 100 octane fuel instead of one rated at 91.

While such engines must be designed structurally for the higher power operation, very little – if any – penalty is paid in terms of engine size or weight by the operator who uses a lower grade of fuel. This compromise makes for flexibility. With engines of such designs, additional advantages will accrue to owners by increases in the compression ratio, spark advance, and other engine variables which promote increased economy.

Investigations by a number of companies have shown that water injection can be used to suppress knock with a total liquid consumption equal to, or less than, the fuel consumption required to suppress detonation. This is true both in cruising and take-off.

Evening Session

The evening and final session consisted of two papers on the highly controversial subject of helicopters. This session was very well rounded, since the first paper by C. T. Doman, Aircooled Motors Corp., covered the problem of adequate engines for helicopters; the second paper covered the design problems involved, by Fred Landgraf, Landgraf Helicopter Co., who reviewed the difficulties encountered in helicopter design. As an added feature following the papers, a motion picture, showing the development and operation of the Bell helicopter, was shown.

Although requirements for helicopter engines are substantially the same as those for airplane powerplants, the very infancy of the industry and the rapid change which it is undergoing make difficult any definition of standards. Mr. Doman outlined the general requirements for a helicopter powerplant. It should incorporate, he said, maximum power, minimum weight, maximum reliability, ability to overspeed, ease of service, and minimum cost. One problem he emphasized as important is that of proper engine design.

Mr. Landgraf, he said, believes that it is the responsibility of engine designers to produce a package power unit for use in helicopters. If possible this should include accessories such as gearing and exhaust system. The current tendency, according to Mr. Landgraf, is to take an engine and add its accessories as afterthoughts, a process which naturally results in a heavier engine.

Mr. Doman feels that Mr. Landgraf's specification of a 216 lb powerplant for a 115 hp unit is ambitious, given cost specifications for a popular price helicopter. This engine should operate smoothly and quietly

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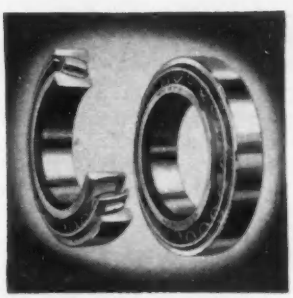


HYATT ROLLER BEARINGS

with minimum fuel consumption, and should be able to accelerate rapidly. A horizontal engine probably would result in a lower cost helicopter, from the point of view of both production cost and ease of repair. Cooling is difficult in the helicopter because at times the engine must operate at full throttle with no forward motion to utilize the slip stream. Self-cooling probably will be done by an axial fan, which has the advantages of simplicity and silence.

Engine weight, Mr. Doman said, is always a compromise between cost, performance and life. For instance, the popular use of magnesium as a means of reducing weight means poor performance for certain parts; lightening out of the crankshaft will often cost more and reduce the life of the part, without a commensurate saving in cost. He believes, however, that as soon as the industry has developed sufficiently to establish a basic type of helicopter, so that concrete specifications can be submitted to engine designers, it will not be difficult to design a power plant to fit the need.

Interesting as a parallel to Mr. Doman's specifications for the ideal helicopter was Mr. Landgraf's catalog of what is wrong with the current helicopter. It is, he said, ugly, noisy, rough, tricky to fly, complicated, expensive, subject to mechanical failure, and poor in load carrying ability.

Mechanical Problems Take Precedence

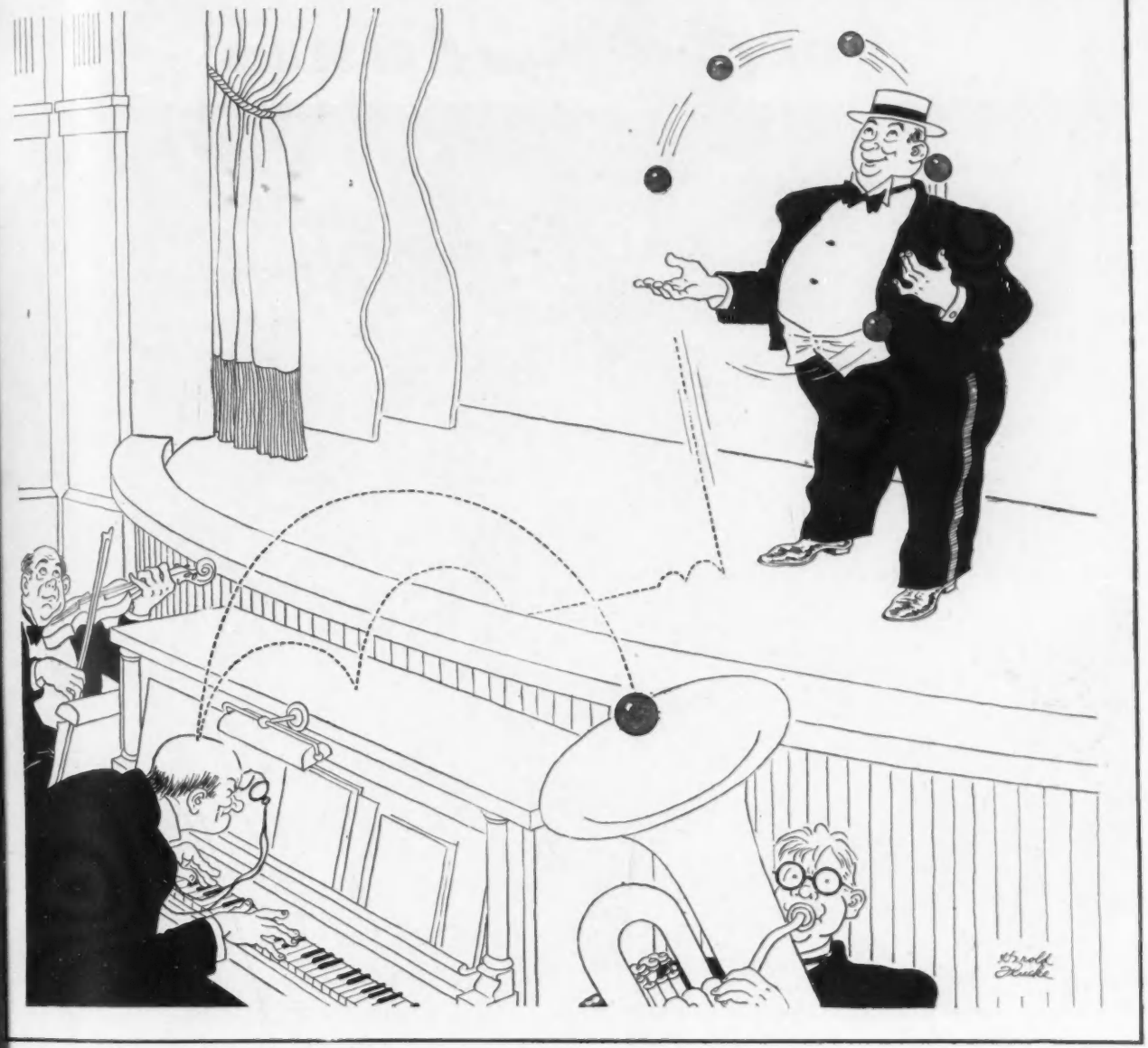
Poor appearance results from the fact that in the present confused status of helicopter design, mechanical problems must take precedence over styling. Noise results from inherent airplane engine noise about which nothing has yet been done. The principal source of noise, Mr. Landgraf said, is the exhaust system, but even if this were silenced, other noises would begin to appear. This is a question for acoustics experts. Roughness comes both from aerodynamic design and from mechanical design.

Most remedies have served only to produce other new difficulties, but such methods of correction as increased blade stiffness, better balance, control through cyclic displacement of blade ailerons rather than movement of the entire blade, and an increase in the number of blades promise some improvement. The problem of tricky flying is accentuated by the requirement of dynamic as well as static stability. There are a number of methods of maintaining stability, and Mr. Landgraf believes almost any will do so long as the pilot does not have to do it.

Cost Will Decrease

Cost and complexity, as functions of design, will eventually be decreased by compromise and standardization. Mechanical failures can largely be corrected by application of new testing techniques developed during the war. The helicopter cannot carry as much load with the same power as the conventional airplane, but there is the possibility of using a supercharged engine in the helicopter, once the cost factor has been overcome.

Mr. Landgraf predicted that the future helicopter engine will be lighter than the present airplane engine, will cost more, and will be worth more. He believes that the troubles facing the industry now are small ones, which can soon be solved by continued research and experimentation.



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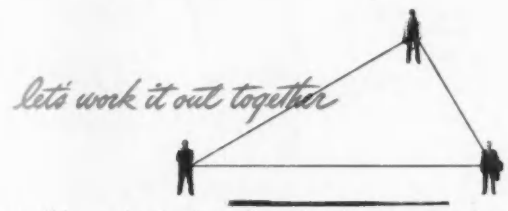

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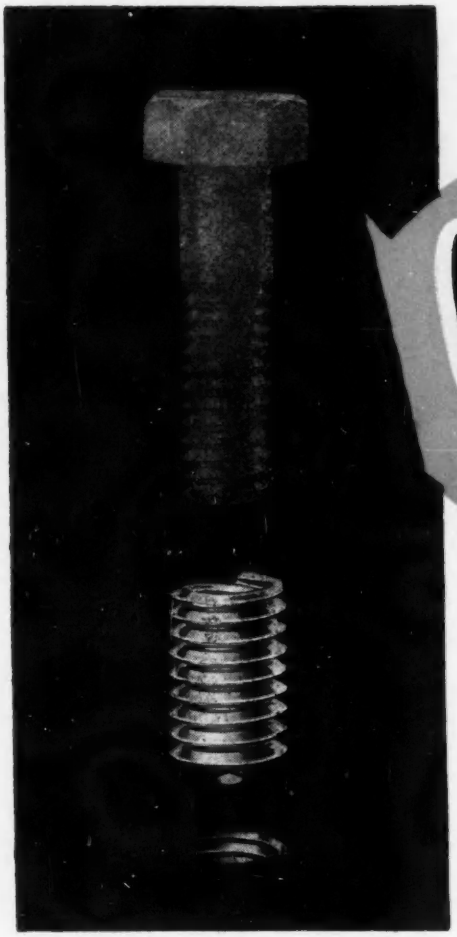

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PREVENT WEAR IN TAPPED THREADS
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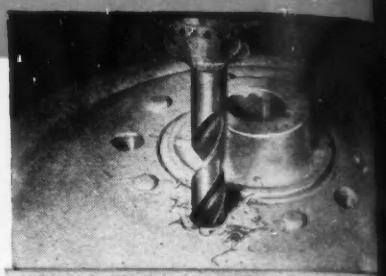

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Line pressure is increased (boosted) by the principle of reduction in diameters as illustrated in Figure (2). If the area of the larger piston was 3 square inches, and the area of the smaller piston was 1 square inch, then fluid pressure of 50 lbs. per square inch in the larger cylinder

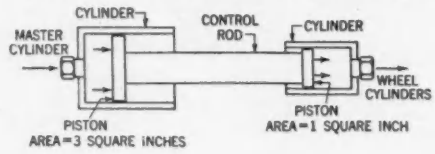

Fig. (1)

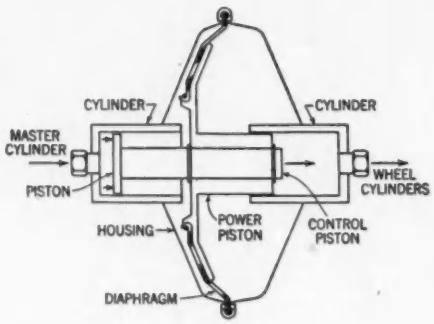

Fig. (2)

would be increased to 150 lbs. per square inch in the smaller cylinder. Obviously, the fluid displacement in the secondary cylinder would be less than that of the primary cylinder if the relative sizes of the pistons remained as aforementioned. To compensate for the loss in fluid displacement volume, the control rod is surrounded by a power piston having the same diameter as the primary piston. The pressure plate of this power piston is connected to the booster housing by a neoprene diaphragm. Vacuum is created (from the manifold) in both sides of the booster housing. The slightest pedal pressure will close the vacuum valve in the unit and open the atmospheric valve to the primary side of the unit. This differential in pressure is utilized to actuate the power piston, which moves with the control piston, thus providing boost in the line pressure with no loss in fluid displacement volume.

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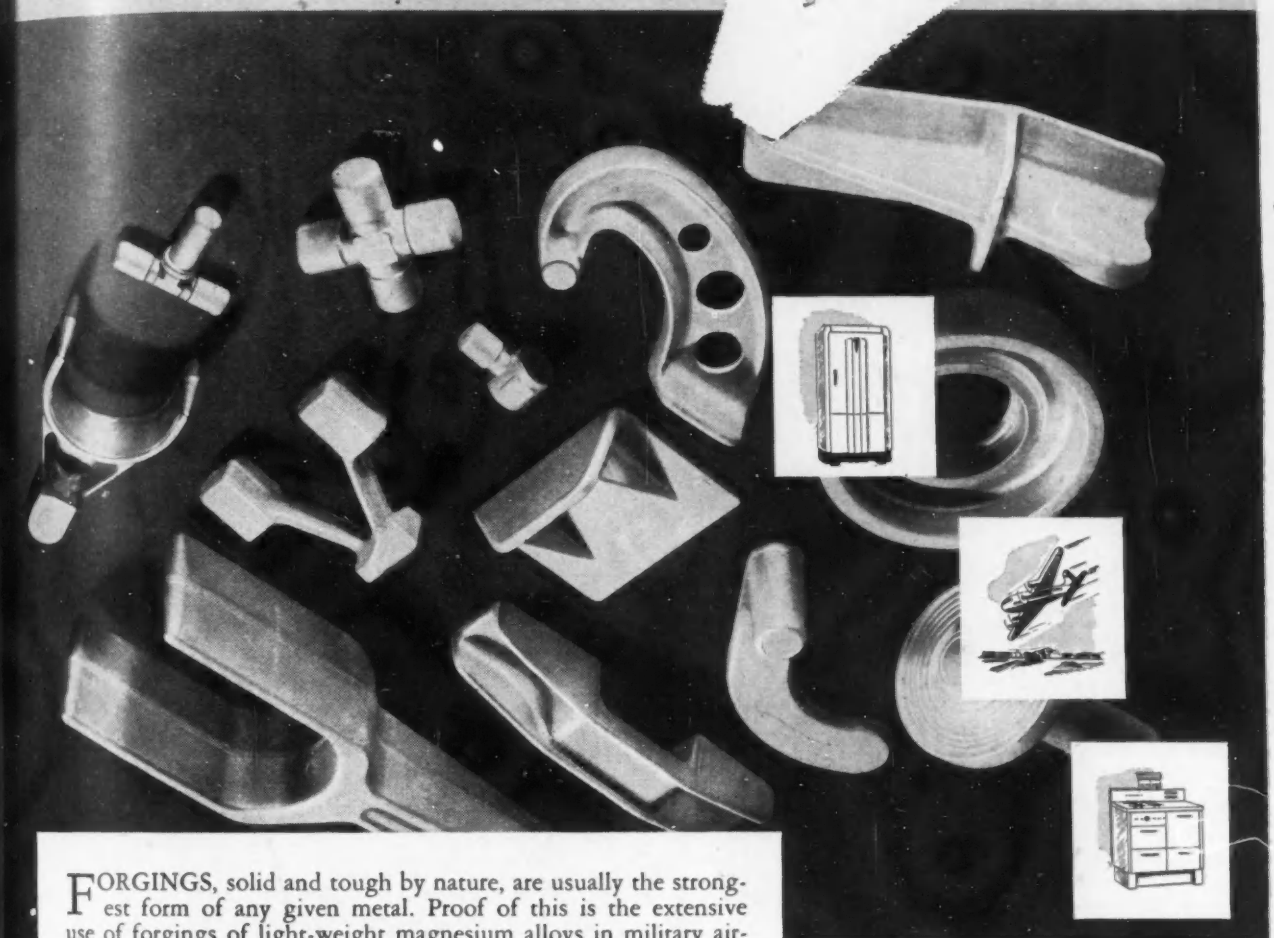

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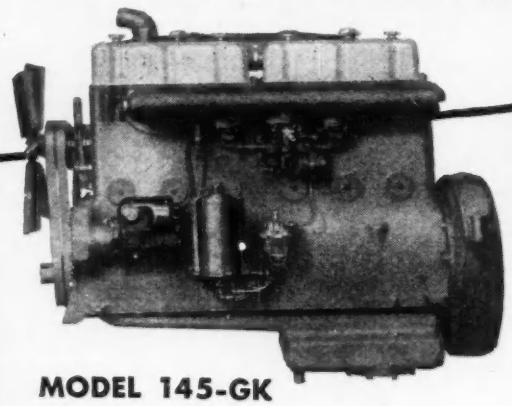

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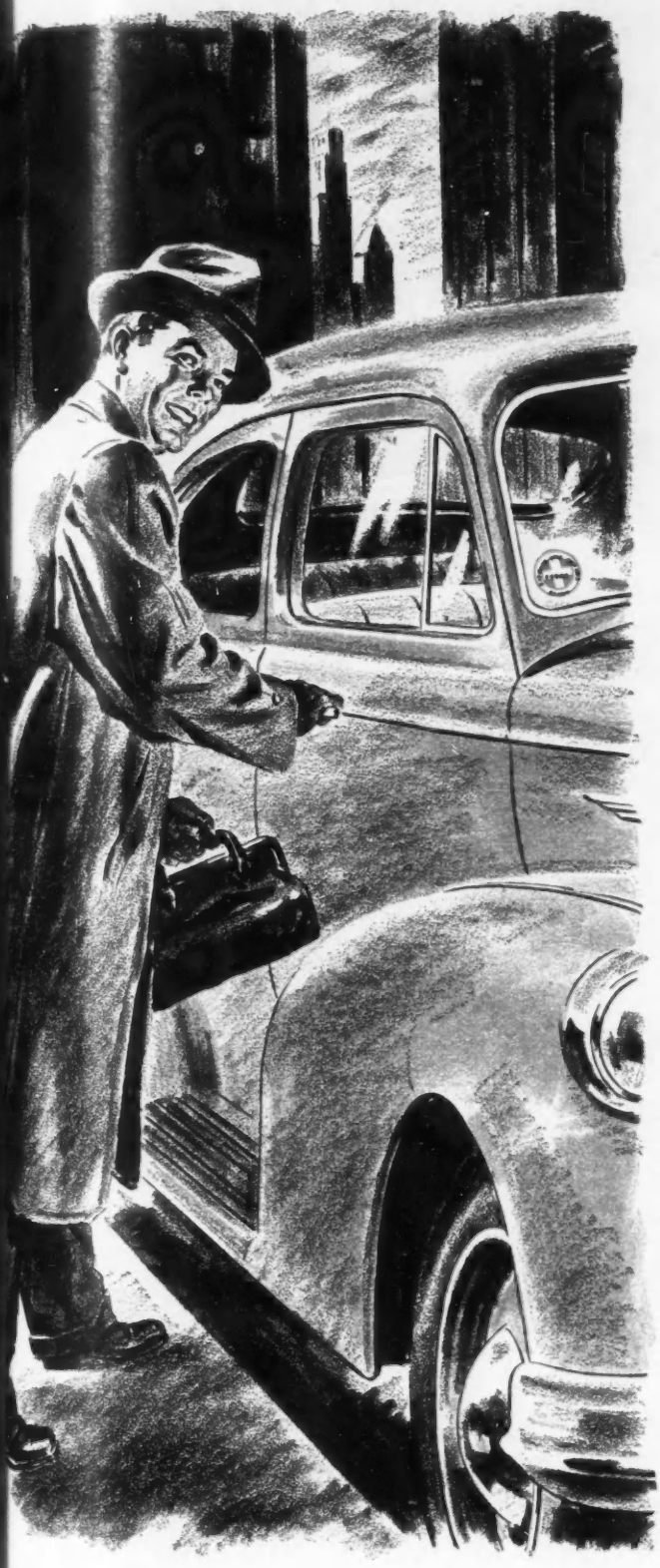

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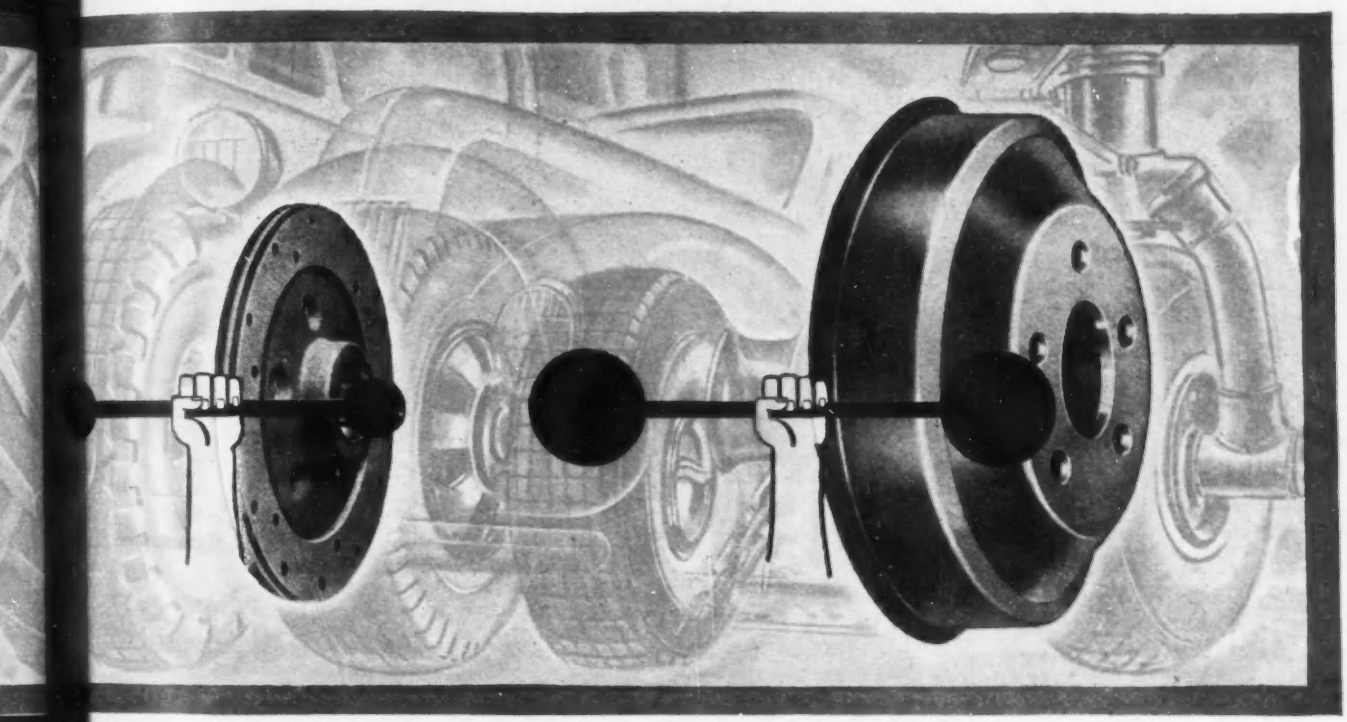

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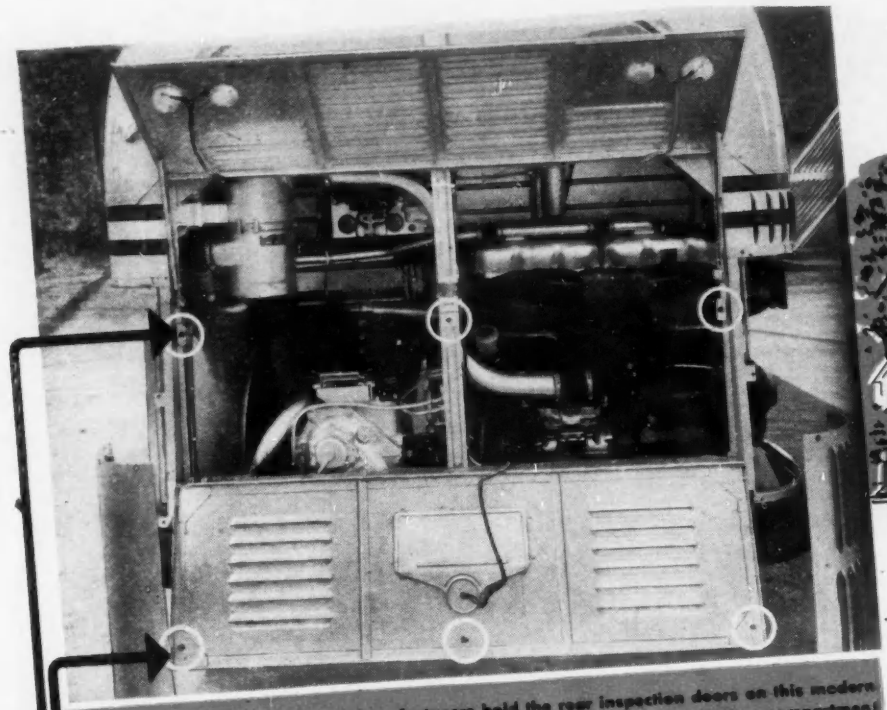

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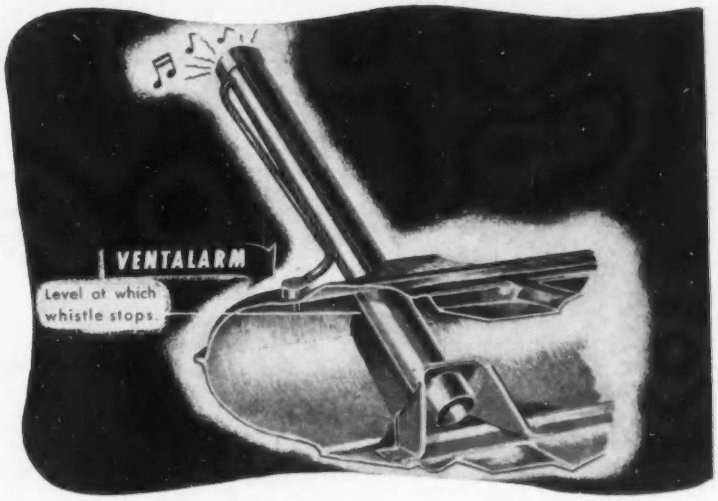
Sub-surface fill combined with VENTALARM provides smooth orderly entry of the gasoline to the *bottom* of the tank. This eliminates evaporation. VENTALARM provides adequate venting, assures increased filling speeds, eliminates blowbacks. VENTALARM establishes a safety zone within the tank, eliminating spills in filling and spills due to expansion. Fire hazard reduced.



VENTALARM is now standard equipment on: ***Buses*** — A.C.F., Ford, General Motors, Mack, Twin Coach and White . . . ***Trucks*** — Divco . . . ***Taxicabs*** — Checker and DeSoto . . . ***Passenger Cars*** — Chrysler Imperial and Packard Clipper

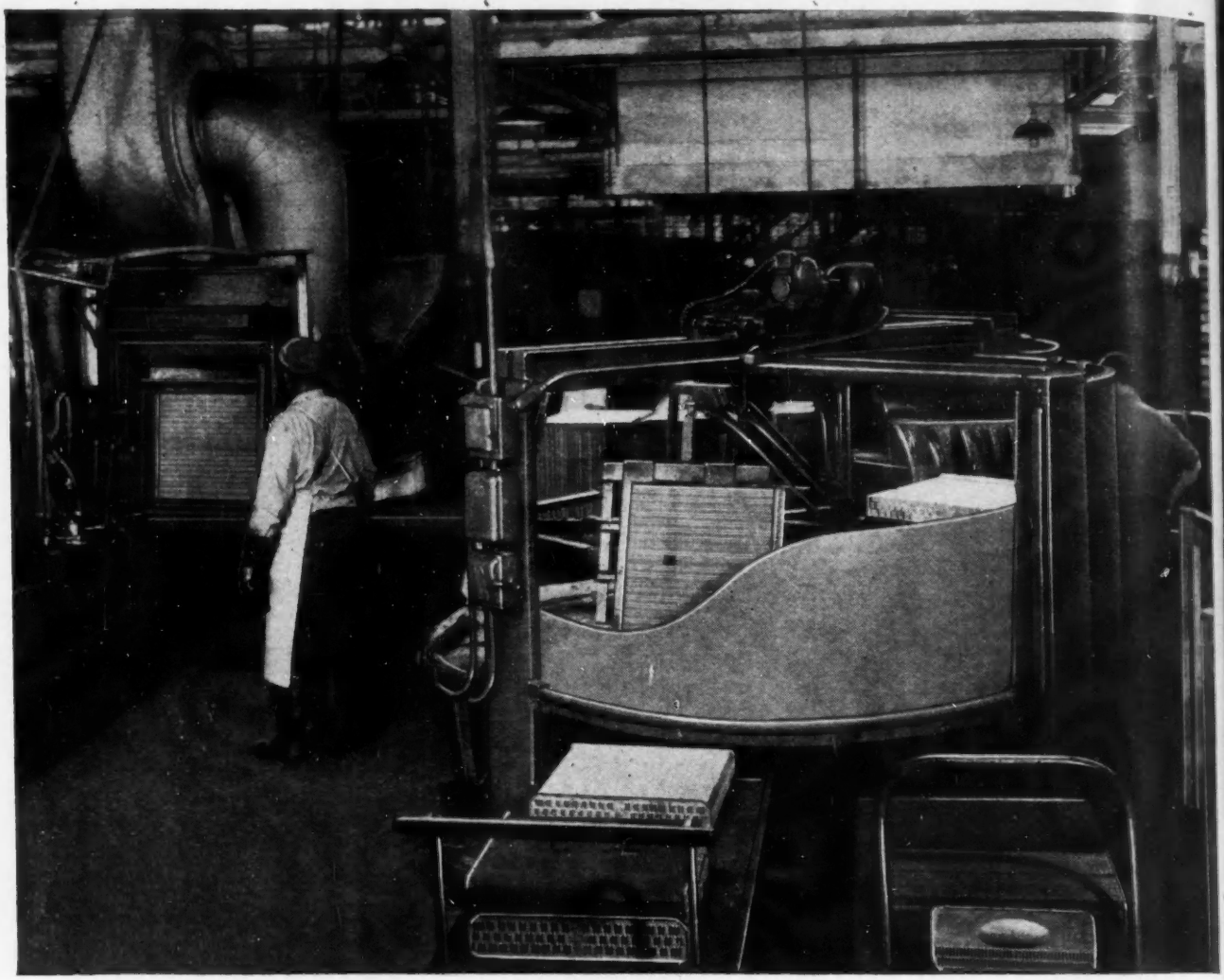
SCULLY

VENTALARM ***The Whistling Fuel Tank Signal***

T M REG U S PAT OFF

Household fuel tank type VENTALARM now assures safe automatic filling in 400,000 homes

SCULLY SIGNAL COMPANY · 88 First Street, Cambridge 41, Mass.

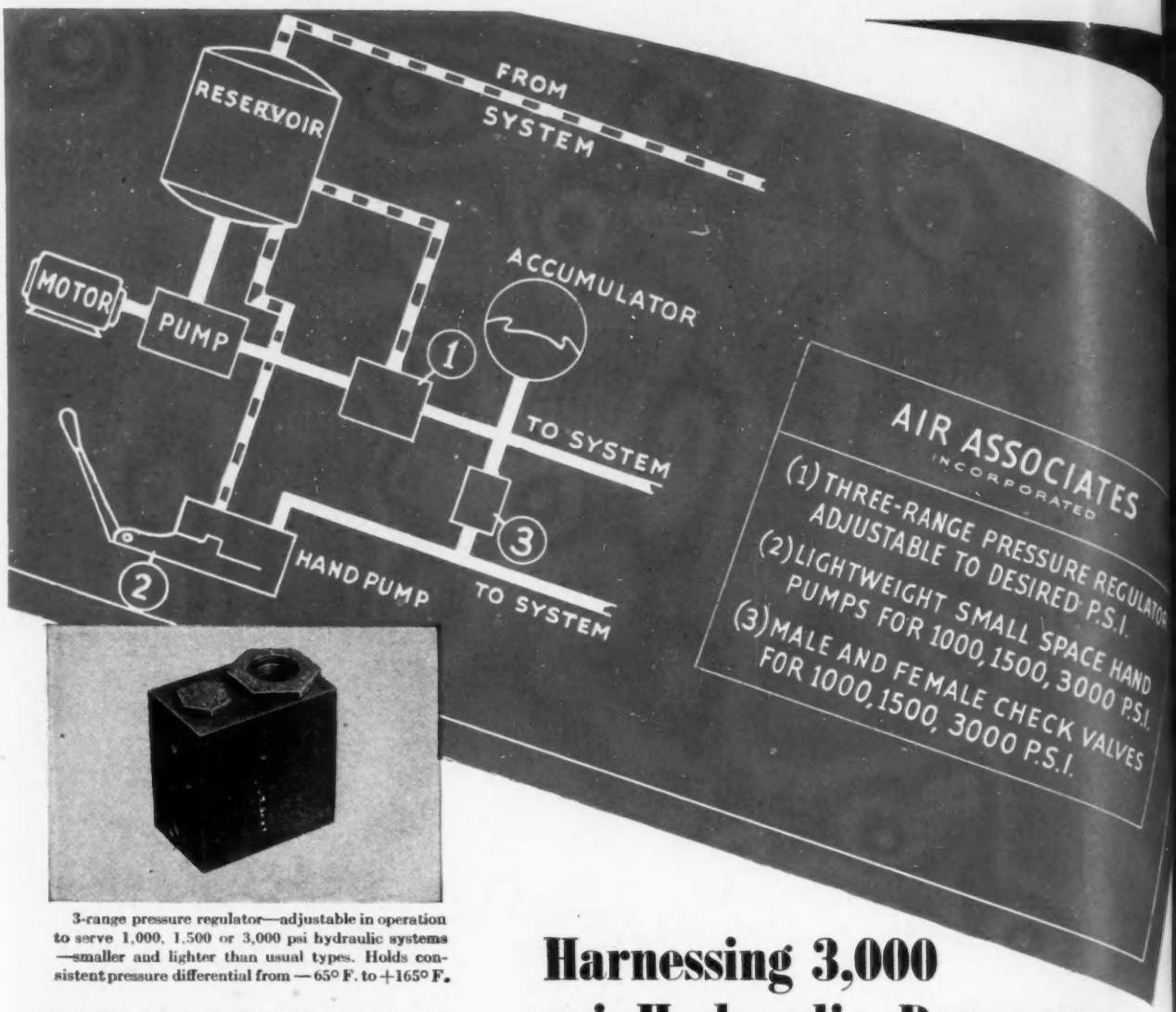


User Satisfaction Starts Here...

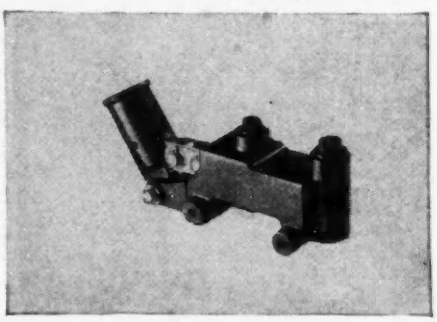
ABOVE: SOLDERING TUBES AND FINS OF RADIATOR CORES . . . careful inspection, to meet quality standards at every step in manufacture, from materials selection to final test, means maximum heat exchange efficiency and trouble-free performance in the user's service. Long Manufacturing Division, Borg-Warner Corporation, Detroit and Windsor.

LONG

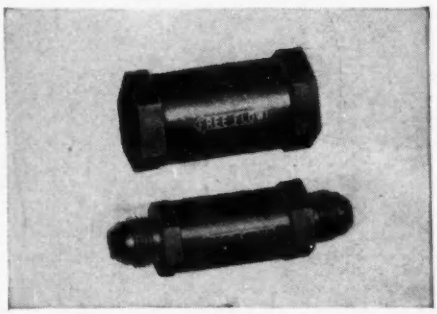
CLUTCHES • RADIATORS • OIL COOLERS



3-range pressure regulator—adjustable in operation to serve 1,000, 1,500 or 3,000 psi hydraulic systems —smaller and lighter than usual types. Holds consistent pressure differential from —65° F. to +165° F.



New 3,000 psi hand pump meets latest A-N specifications—is lighter in weight, requires less space than conventional hand pumps. Weighs only 1.25 lbs.



New check valves for 1,000, 1,500 and 3,000 psi hydraulic systems employ either plastic button poppets mounted on metal guides or steel ball poppets.

Harnessing 3,000 psi Hydraulic Pressure

The extra advantages of 3,000 psi hydraulic pressure can now be utilized completely with three new items of Air Associates design and manufacture . . . a small, light, adjustable 3-range pressure regulator . . . check valves, plastic-on-metal poppet type or steel ball type . . . and a low-weight, high-capacity hand pump . . . All meet latest Army-Navy Specifications.

The compactness and light weight of these units recommend them to aircraft manufacturers. But their dependable and accurate functioning in heavy service and temperatures ranging from —65° F to +165° F . . . suggest significant new potentials for hydraulics applications in all industries!

Air Associates is also prepared to make actuating cylinders suited to your individual 3,000 psi hydraulics requirements. Detailed specifications on all AA hydraulics equipment on request . . . Inquiries are invited.

• AIR ASSOCIATES
INCORPORATED

TETERBORO, N. J. *Branches:* ATLANTA, CHICAGO, DALLAS, LOS ANGELES
ENGINEERS AND MANUFACTURERS OF AIRCRAFT SPECIALTIES . . .
SUPPLIERS OF ALL TYPES OF MATERIALS TO THE INDUSTRY SINCE 1927

¼ inch = 9 miles up

Just imagine trying to measure 47,520 feet with a ruler only a quarter of an inch long! That in effect is what the diaphragm of the altimeter in the picture does.

Each time the 'plane climbs 20 feet, the lessening air pressure expands the diaphragm nine one-hundred-thousandths of an inch—equivalent to approximately 1/13th the diameter of a human hair—but when the 'plane is nine miles high the total of the device's expansion is *only a fourth of an inch.*

C. G. Conn, Ltd., of Elkhart, Ind., manufacturers of the altimeter, were able to reduce rejections of diaphragms from 30% to just 5% when they switched to Western Super-X phosphor bronze. Thus, keeping 'planes flying just where they ought to be is another of the many war jobs being performed efficiently by a Western "tailor-made" copper-base alloy.

You, too, might find it beneficial to investigate Western metals. Our mills at East Alton, Ill., and New Haven, Conn., deliver alloy metals as *specified* . . . in sheet, strip, long coils or stamped parts. Your inquiry will be welcomed.

WESTERN BRASS MILLS

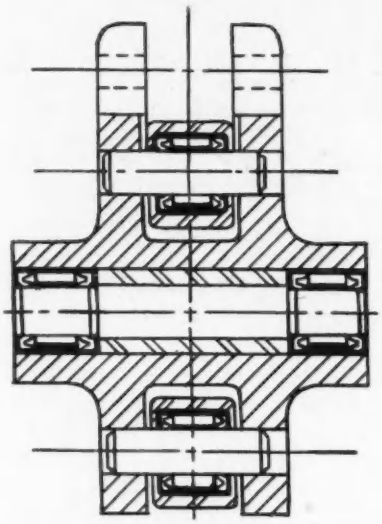
DIVISION OF OLIN INDUSTRIES, INC.

East Alton, Illinois

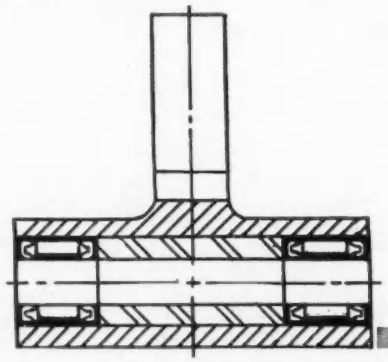
Super-X PHOSPHOR BRONZE

DIVISION OF OLIN INDUSTRIES INC.

BRASS • BRONZE • PHOSPHOR BRONZE • NICKEL SILVER • COPPER



Four Torrington Needle Bearings are shown in the above cross-section drawing of the lever assembly of a landing gear 4-way valve, as used in the Douglas DC-4 Skymaster. Below is a cross-section view of the cam assembly of the same valve, in which two Needle Bearings are used. Torrington Needle Bearings effect savings in space and weight, yet maintain dependable, anti-friction performance.



Douglas DC-4 Skymaster Hydraulic Control Operates Smoothly on Needle Bearings

In the Douglas C-54 (DC-4) Skymaster, as in many other types of aircraft, where savings in space and weight mean *increased payload,* Torrington Needle Bearings play a vitally important part. That is only logical, because Needle Bearings are compact and light in weight, and yet do not sacrifice any of the equally important qualities of high load capacity, dependability, long service life or ease of operation under severe conditions.

Regarding the application of Torrington Needle Bearings in the lever and cam assemblies of a 4-way valve of the Skymaster's landing gear, Douglas engineers have this to say, "A saving in both weight and space were effected where the anti-friction qualities and high load capacity of the Needle Bearings were required to accomplish a smooth action of this hydraulic control."

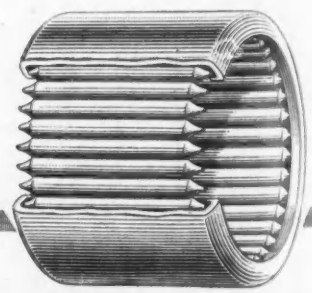
These plus features, combined with low initial cost and ease of installation and lubrication, tell you why, in the aeronautical, automotive and related industries, Torrington Needle Bearings are used in a wide range of applications. Write for our Catalog 32 for complete Needle Bearing information.

THE TORRINGTON COMPANY

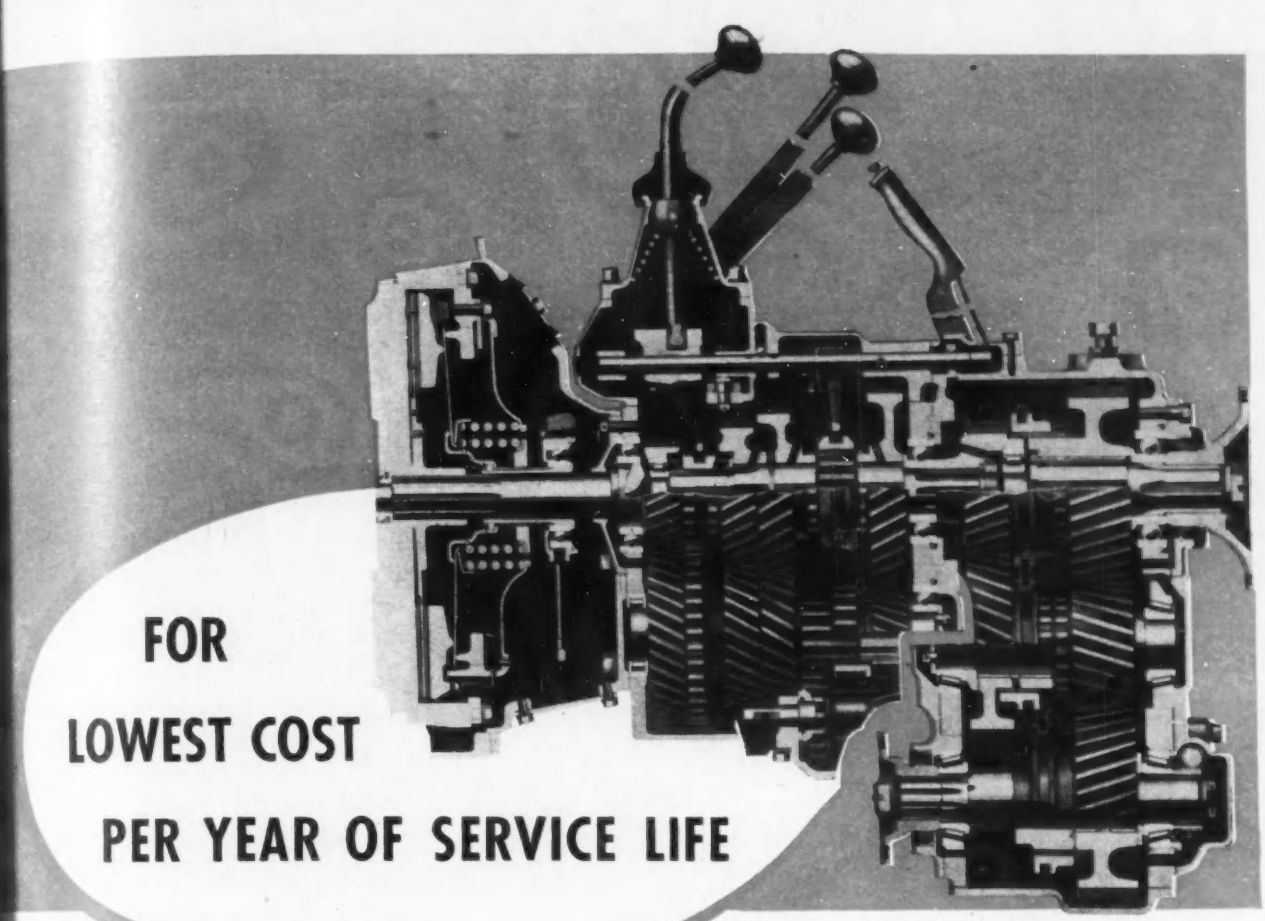
Established 1866

TORRINGTON, CONN. • SOUTH BEND 21, IND.

New York Boston Philadelphia Cleveland Detroit Seattle Chicago San Francisco Los Angeles Toronto London, England



TORRINGTON NEEDLE BEARINGS



FOR LOWEST COST PER YEAR OF SERVICE LIFE

—no other material can equal *ALLOY STEELS*

You just can't beat alloy steels for length of service life. They permit engineers to develop longer-lasting designs and assemblies which continue their superior performance under adverse conditions long after ordinary steels have worn out or failed.

That's why they cost less per year of service life, even though their first cost may be higher than that of less efficient grades of steel. And that's why you should use alloy steels for gears, shafts, bearings and shifting mechanisms, as shown above, and for all other vital operating parts of your product.

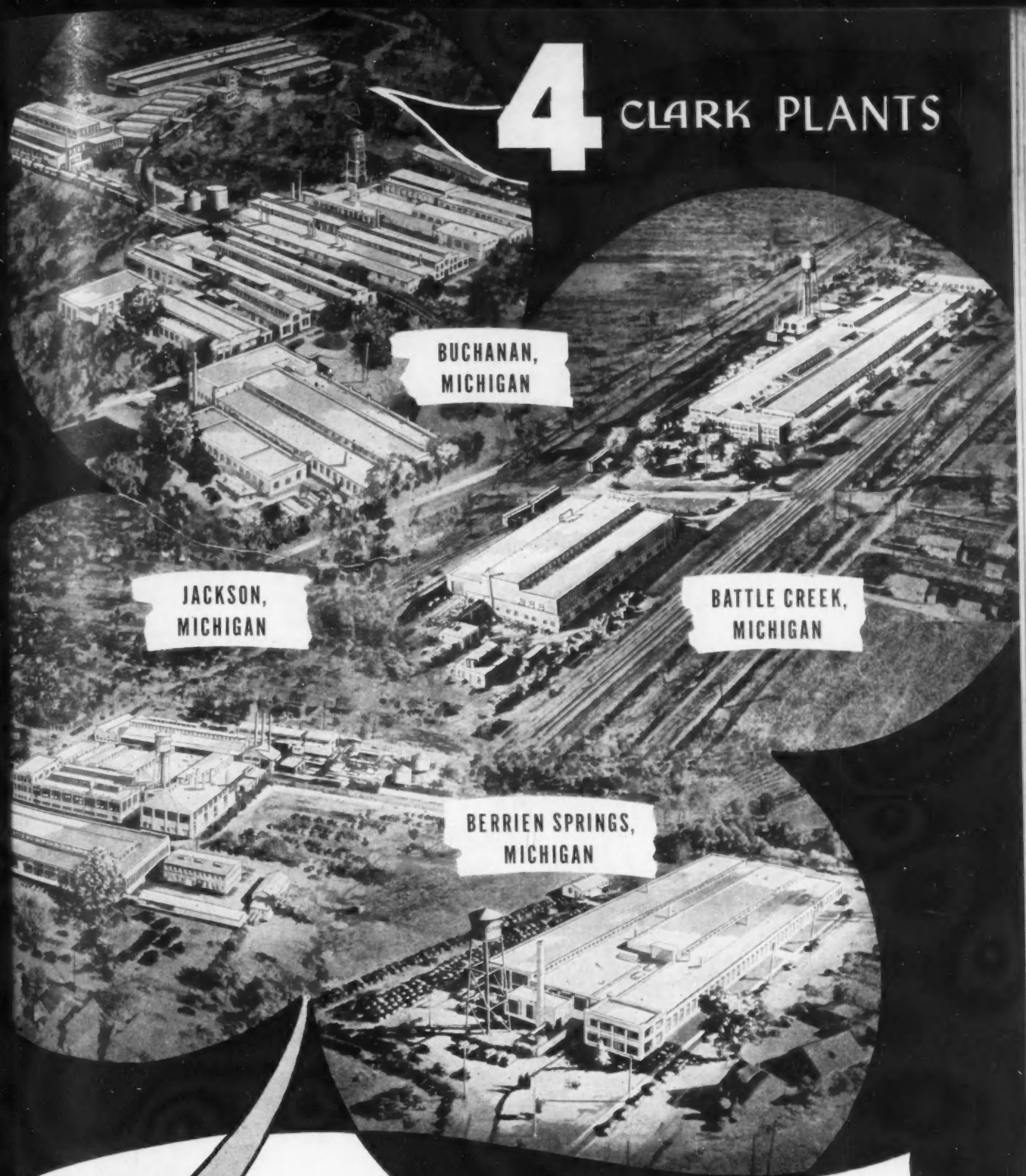
Alloy steels have other qualities which recommend them for your use, too. Their high strength-to-weight ratio permits the use, with safety, of lighter equipment and smaller sections. Their super-toughness provides protection against severe shocks, reversal of stresses or overloading. Their uniform hardness means reduced wear.

Republic—world's leader in the production of alloy steels—is ready NOW to assist you in the most efficient and most economical application of these fine steels. Write to—

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic
ALLOY STEELS

Other Republic Products include Carbon and Stainless Steels—Pipe, Sheets, Strip, Plates, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing



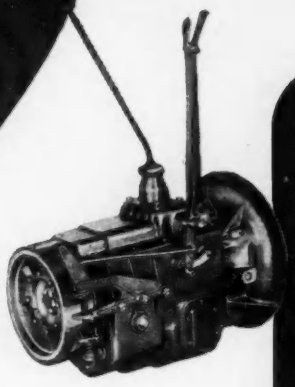
Fine quality **HAS MANY DWELLING PLACES**

...and in none is it more truly and deeply respected than in these four busy factories of Clark. For in them the Men of Clark build their products—and put into those products all the sound engineering, the seasoned "know how," the zeal for accuracy which are the working creed of all true craftsmen.

SEE OTHER SIDE

CLARK EQUIPMENT COMPANY

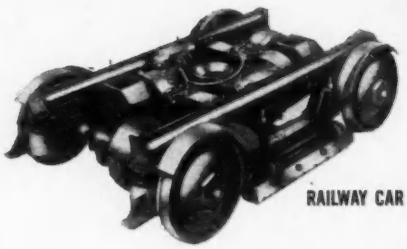
12 GUARDIANS OF A GOOD REPUTATION



TRANSMISSIONS

METAL SPOKE WHEELS

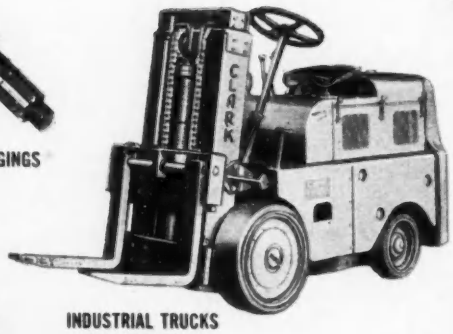
AXLE HOUSINGS



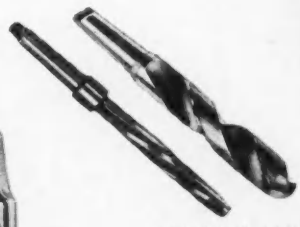
RAILWAY CAR TRUCKS

FRONT AND REAR AXLES
FOR TRUCKS AND BUSES

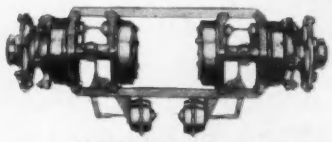
GEARS AND FORGINGS



INDUSTRIAL TRUCKS
AND TRACTORS

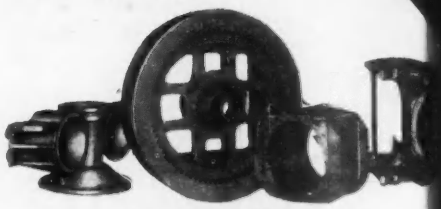


DRILLS AND REAMERS

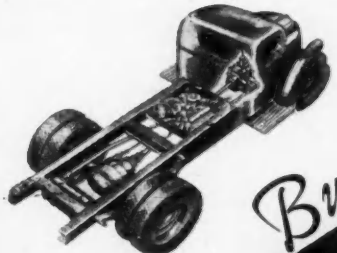


EASY ROLL TRAILER AXLE

BLIND RIVETING PROCESS



ELECTRIC STEEL CASTINGS



BOOSTER UNITS

This is the family of products bearing the respected name of CLARK

These are good workers—"built to do a better job": To deliver a well engineered usefulness, to perform at lowest possible cost, to guard well the wholesome reputation that is built into them.

Built to do a Better Job

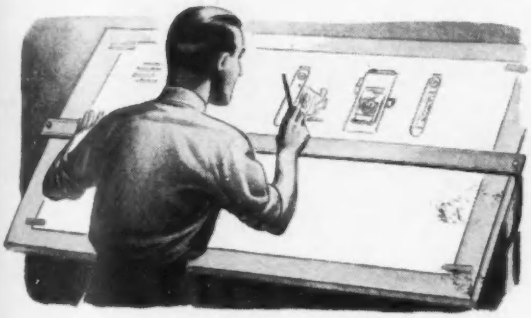
CLARK EQUIPMENT COMPANY
Buchanan, Michigan
Also—BATTLE CREEK—JACKSON—
BERRIEN SPRINGS, MICHIGAN

TROUBLES SUBSIDE

It was a slow and troublesome job to drive small slotted screws in fastening a pressed fabric panel on this electrical relay for the P-80 Jet Plane. Frequent driver skids gouged the special fungus-resistant varnish, forced disassembly and junking of marred panels.

OUTPUT HITS STRIDE

Assembly of this part was speeded up 400% when a change was made to Phillips Recessed Head Screws. Fumbling was ended, and a spiral driver could be used, permitting faster driving. Driver skids were eliminated, along with waste of parts and time for disassembly and reassembly.



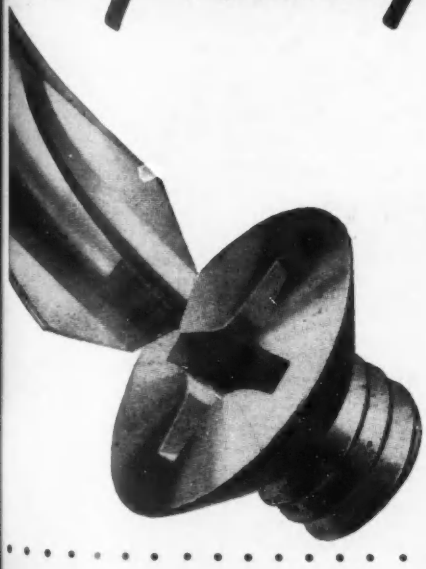
NEW STRENGTH SUPPLIED

Design engineers favor Phillips Screws, because they not only speed output and reduce costs . . . they also permit design improvements that add strength, often with the use of fewer screws. This advantage is especially evident in compact, complicated assemblies.

SHOW IT WITH PRIDE

Wherever screw heads are exposed, the Phillips Recess adds a sales advantage. No unsightly burrs to snag clothing or nick fingers – and sidetrack sales! Its ornamental design blends with modern contours – and it needs only a quarter turn to line up – looks well in any position.

It's *Phillips* ... the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

THIS *New* TRUCK-BUS RIM *Has Everything*

- **WIDE BASE—Full 70% Rim\Tire Ratio**
- **CONTINUOUS BASE • CONTINUOUS SIDE RING**

Plus 5° TAPERED BEAD SEATS AT BOTH FLANGES

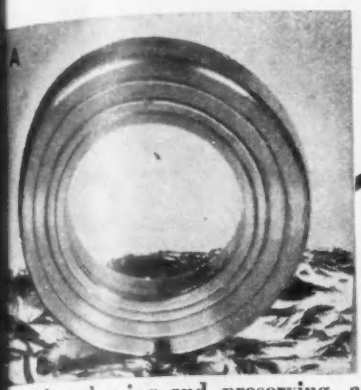
THE Firestone Double 5° (Advanced) Rim is the rim that all vehicle manufacturers have been waiting for — with outstanding new improvements developed and tested for peak performance under the most severe operating conditions.

The new 5° full width tapered bead seat on the ring side of the rim is the most revolutionary development in rim engineering in years. Previously it has been possible to incorporate this feature only on the flange side. The new Firestone rim, incorporating *full width* 5° tapered bead seats on *both* sides, assures greater tire stability, prevents rocking, avoids bead failures, increases tire mileage. Yet a simplified new design permits quick and easy changing of the tire.

Firestone Double 5° (Advanced) Rims are made for both demountable and non-demountable (disc wheel) application. Demountable types interchange on the 28° mounting bevel, developed by Firestone and now accepted as industry standard, and are interchangeable with Firestone RI and R Rims. For complete information write FIRESTONE STEEL PRODUCTS COMPANY, AKRON 1, OHIO, or see your Firestone representative.

Firestone

ADVANCED TRUCK-BUS RIMS

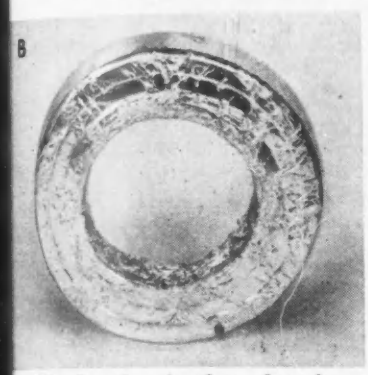


A

After cleaning and preserving, a bearing is placed upright on a single sheet of Reynolds Aluminum Foil.

Moisture vapor can't get in!

new corrosion-proof wrapping for small metal parts



B

The bearing is then doughnut wrapped and the foil pressed firmly and smoothly to the bearing to take advantage of Cathodic Protection.

C_1

This bearing may then be plastic dipped . . . or . . .

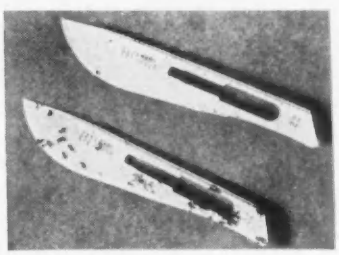
REYNOLDS ALUMINUM FOIL safeguards small metal parts two ways:

1. **Acts as a positive barrier against moisture vapor transmission.**
2. **Develops a counter electro-magnetic force that provides cathodic protection against contact corrosion.**

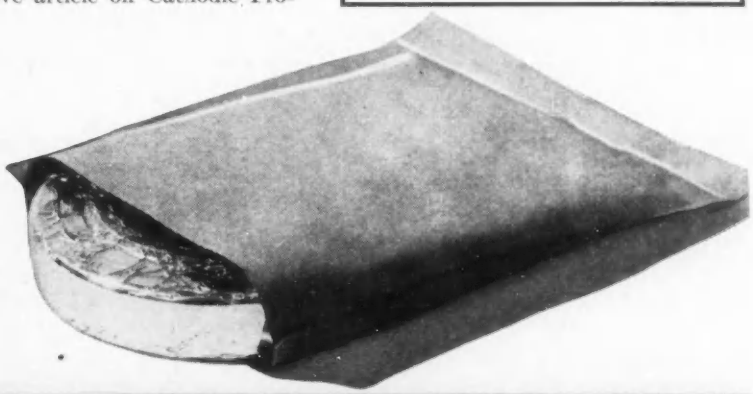
Reynolds cooperated with the Army Medical Corps in making tests by wrapping surgical instruments in Aluminum Foil. So successful were the results, that the Medical Corps specified Aluminum Foil for this new method of packaging, combining "Cathodic Protection" with a moisture vapor barrier. (See actual photograph of test shown on this page.)

Experience gained under severe wartime conditions has made possible revolutionary advances in parts packaging. These are now available for packaging many civilian products.

If you would like a reprint of a recent authoritative article on Cathodic Protection, as well as complete data on the new uses of Aluminum Foil in packaging metal parts, write Reynolds Metals Company, Richmond 19, Virginia.



SURGICAL BLADES used in Army Medical Corps experiment. Blade above wrapped in foil—below in neutral paper. These are the results after 11 days at 122°F., 95% relative humidity. In both cases, blade was cleaned and preserved before wrapping.



The bearing may be placed in an approved Reynolds bag and heat-sealed. For domestic packaging, the part can be wrapped as in B, then placed in laminated foil carton for extra display value.

REYNOLDS METALS

REYNOLDS METALS COMPANY

Leads the way in Foil Packaging

torsional . . . . . vibration

JUST RELEASED for general distribution:

"EVALUATION of EFFECTS of TORSIONAL VIBRATION"

The most valuable basic treatise on this subject is the NEW SAE War Engineering Board report, developed for the Navy Bureau of Ships.

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SIMPLIFICATION OF INSTRUMENTATION FOR INDICATING DANGEROUS STRESSES, and REPORTS of SAE TORSIONAL VIBRATION SUB-COMMITTEES.

578 pp., 8½ x 11 in., profusely illustrated with photographs and 134 full-page drawings, charts, and graphs. Bound in clothboard covers. PRICE: $5.00 to SAE Members, $10.00 to Non-members.

TEAR OFF and MAIL:

Society of Automotive Engineers, Inc.
29 West 39th Street
New York 18, New York

Please send me, at the address below, copies of the report checked:

EVALUATION of EFFECTS of TORSIONAL VIBRATION . . . . . ☐

SAE Members $5.00 – Non-members $10.00

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(signed)

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(number and street)

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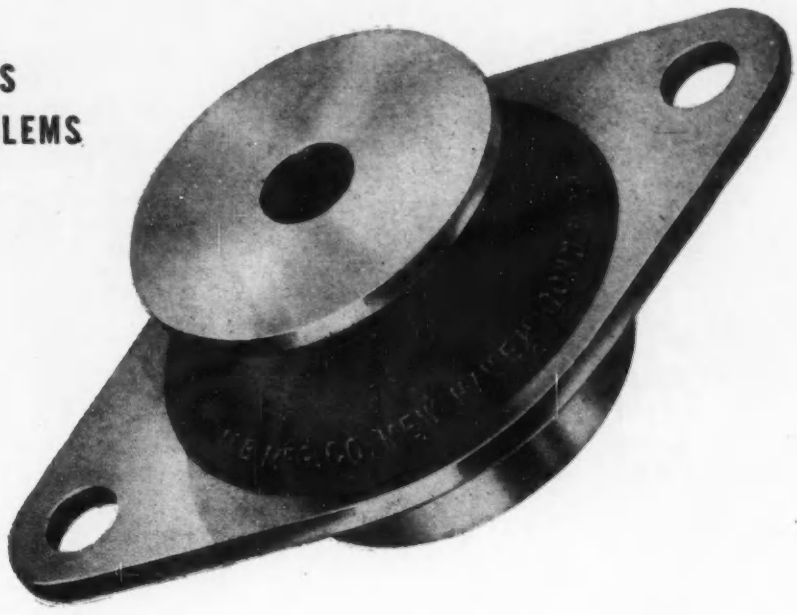
(city) (P.O. zone) (state)

IT'S THE MB ISOMODE MOUNT FOR POSITIVE VIBRATION CONTROL . . .

STACK UP THESE PROPERTIES AGAINST YOUR DESIGN PROBLEMS

- Equal spring rates in all directions
- Non-directional—mount at any angle
- High load capacity in compact size
- Ample rubber for high deflection capacity
- Self-snubbing for overloading shocks
- Convenient mounting flange



PREVENT TRANSMISSION OF ALL MODES of disturbing and damaging vibrations with these unusually effective MB mounts. Engineered by vibration specialists, Isomodes have the same softness axially and radially. They'll isolate, to a high degree, all modes of motion . . . horizontal, vertical and rocking.

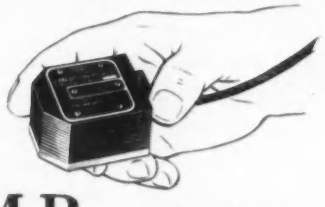
MB Isomodes come in a range of spring rates and sizes for your light, medium, and heavy-weight mechanisms. Let us show you how Isomodes can fit into your present or proposed plans, save you considerable design effort, and assure top anti-vibration performance. Write for details.

"ISOLATE ALL MODES FOR POSITIVE VIBRATION CONTROL"*

THE
MB
MANUFACTURING COMPANY, INC.
Vibration Division
1060 State Street, New Haven 11, Conn.

VIBRATION MB DIVISION

Another Helping Hand on Vibration Problems



MB VIBRATION PICKUP

Developed for both vibration detection and as an aid to its analysis, the MB Pickup features excellent response to very low amplitudes . . . exceptional durability under conditions of severe vibrations . . . negligible frictional effects . . . and calibration stability over broad temperature ranges. Output is proportional to vibratory velocity, with effective frequency range 5 to 1000 cps. The MB Pickup is usually operated as a seismic instrument, and is quickly converted for use in either horizontal or vertical plane without affecting calibration. Write for 4-page folder with full details and description.

VIBRATION ISOLATOR UNITS AND MOUNTINGS • SPECIAL VIBRATION TEST EQUIPMENT

HELPS SOLVE HEAT PROBLEMS THAT GO WITH SUPERCHARGING

There's more heat to be disposed of when an engine is supercharged—heat generated because, without any increase in engine size or weight, an engine is putting out more power. This heat must be carried off through cylinder walls, cylinder heads and pistons.

Aluminum's superior thermal properties make it a natural for this assignment. Cylinder heads and pistons of Alcoa Aluminum distribute that heat quickly and uniformly, thus preventing destructive temperatures.

Manufacturers' designs of cylinder heads and oil-cooled pistons, developed with the assistance of Alcoa engineers, assure maximum efficiency and safety in the operation of supercharged engines. The benefits gained by this experience are yours for the asking. Write ALUMINUM COMPANY OF AMERICA, 2181 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

FLYING for the A.T.C., hundreds of Douglas 40-passenger Globesters make round-the-world trips every week. On flights like these, passengers expect the *comfort* of dependable heat—they *get* it by the use of Janitrol Whirling Flame Aircraft Heaters.

Heat for the cabin is provided by two 100,000 Btu Janitrols which can be operated together or as separate units depending upon requirements. Cockpit is warmed by a single 40,000 Btu unit operating independently of the cabin heaters. Motor driven blower supplies air for ground operation; ram air is used when in flight.

More than 3000 Janitrol combustion type heaters were installed in Douglas C-54's for wartime flying. The proven performance of these heaters, operating under the severest kind of flying conditions, leads Douglas to specify Janitrol equipment for cabin heating and thermal anti-icing applications on the new C-74 Globemaster.

Compactness and light weight saves valuable pay-load capacity. Maintenance costs are low—1,000 hours of heater operation without service is not unusual. Inspection and service are easy because of the accessibility of all Janitrol component parts.

Complete Janitrol Heating Package for DC-3 Planes Will Soon Be Available

Complete compact heating systems with all necessary controls—includes blower for ground operation.

By utilizing existing DC-3 duct work, installations can be made quickly and economically.

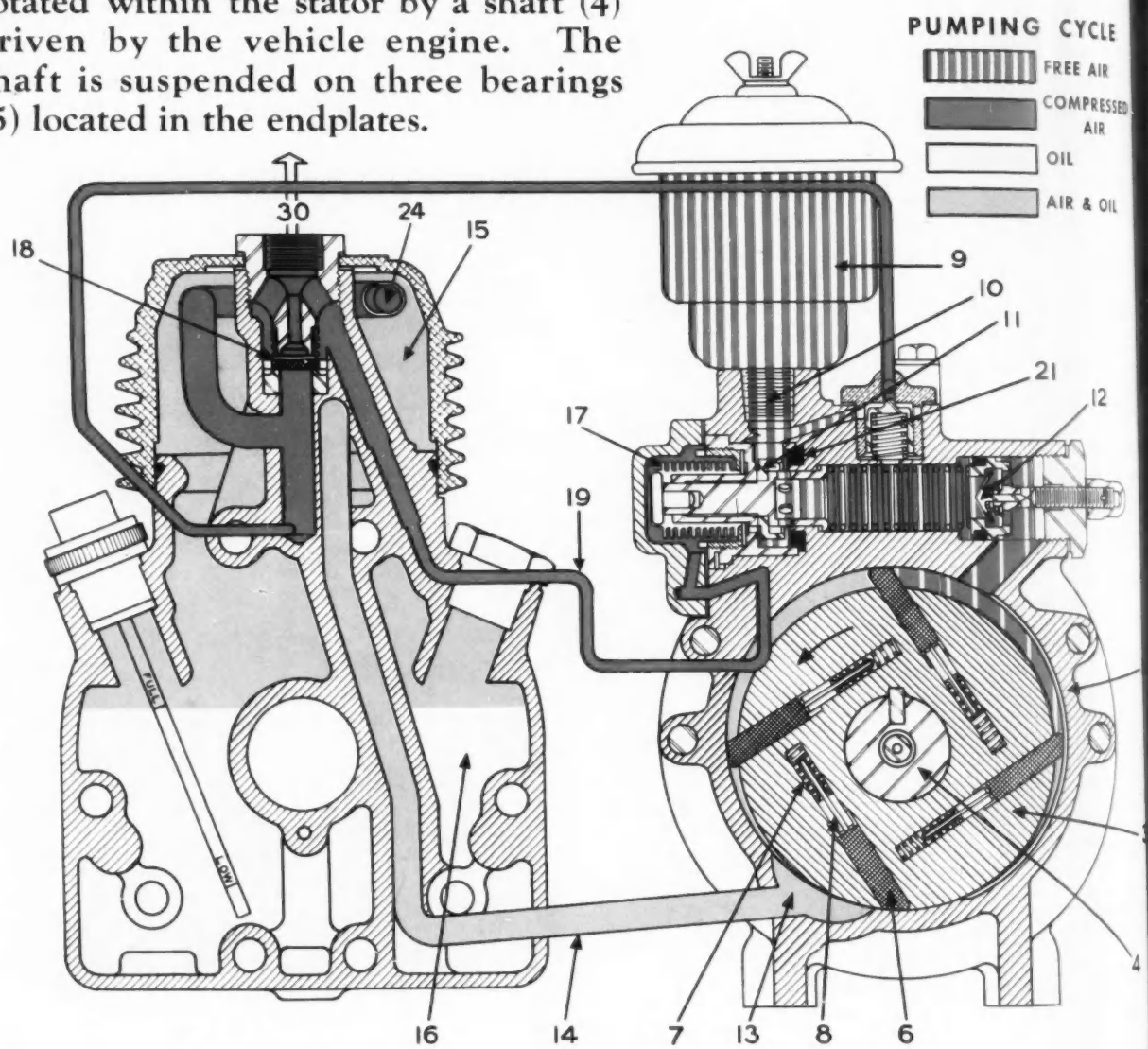
These new Janitrol systems were designed especially for DC-3's, to improve passenger comfort and to reduce heating maintenance costs. All component parts have been proven in military and transport service.

Janitrol

AIRCRAFT HEATER DIVISION • SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

Wagner Air Brakes--the system with the rotary compress that provides abundance of air for all braking nee

The Wagner rotary air-compressor consists of a cylindrical stator (1), two endplates (2), and a rotor (3) which is rotated within the stator by a shaft (4) driven by the vehicle engine. The shaft is suspended on three bearings (5) located in the endplates.



How the air is compressed

The rotor is positioned off center in relation to the stator; it just clears the stator at the bottom, while the top clearance is relatively large. Four rotor blades (6) slide in slots equally spaced in the rotor. Springs (7) and pushpins (8) located in each rotor slot keep the blades in constant contact with the stator bore.

As the rotor revolves, the volume between the blades, rotor, and stator is reduced, and the air trapped is compressed until it is forced out of the stator. Air drawn into the rotary compressor is first passed through an oil-bath air-cleaner (9) where it is thoroughly cleansed. It then passes into the air-inlet passage through the intake valve (11) and the inlet check valve (12) into the compressor.

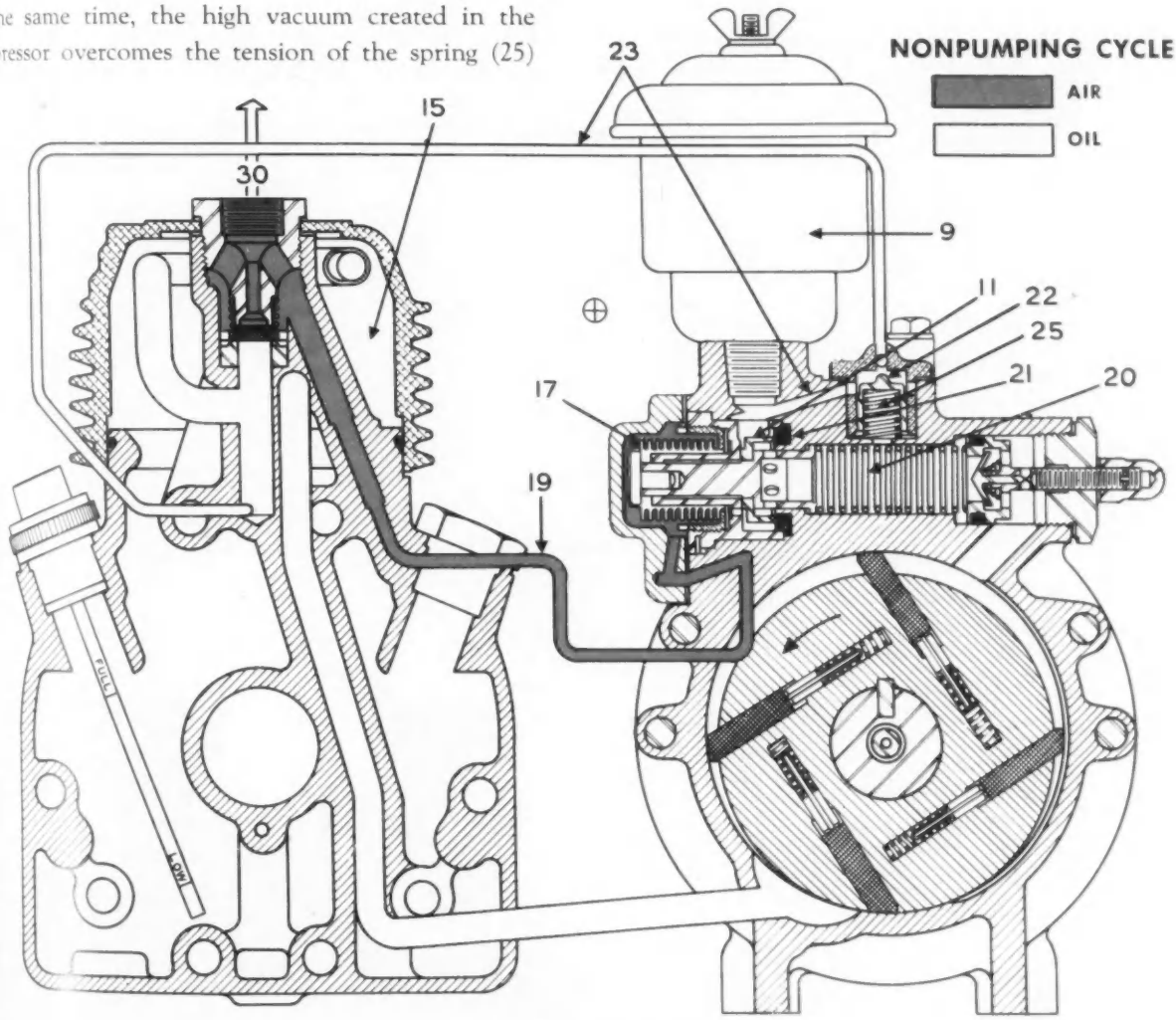
After the air is compressed (at 100 pounds) it passes through the escape port (13), through the air duct into the oil dome (15) where the oil collects and drops into the oil reservoir (16) while the oil-freed air passes on to the air reservoir (30).

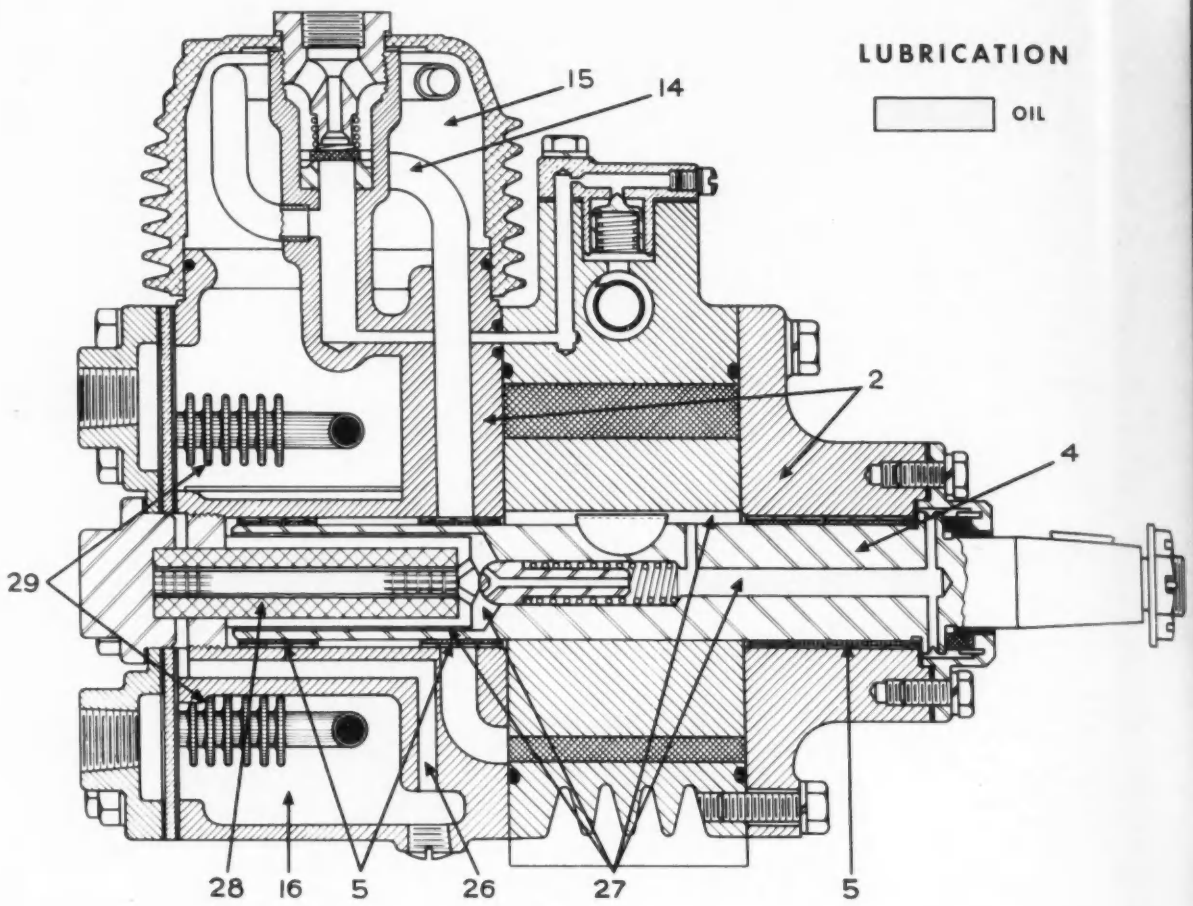
How the pumping cycle is controlled

As long as the air pressure in the oil dome (15) is higher than in the air reservoir (30), the compressed air passes through escape tube (24) and outer check-valve (18) into the air reservoir. But when the predetermined maximum pressure of approximately 100 pounds has been built up in the reservoir and the pressure-regulating passage (19), the air pressure on the sylphon (17) exceeds the tension of the regulating spring (20), causing the intake valve (11) to move toward the valve body seat (21), reducing the volume of air entering the compressor. As the air-intake opening is reduced, a vacuum is created below the intake valve (11), accelerating its movement toward the valve body seat (21) and firmly seating it thereon. Thus the air-inlet port is closed and compression is stopped.

At the same time, the high vacuum created in the compressor overcomes the tension of the spring (25) and unseats the dome relief valve (22). As this valve is opened, the air pressure in the oil dome (15) escapes to atmosphere through the dome-unloading passage (23) and the air-cleaner (9).

When the pressure in the air reservoir (30) drops to approximately 85 pounds, the tension of the air-pressure-regulating spring (20) overcomes the combined vacuum in the compressor and air pressure on the sylphon (17), unseating the intake valve (11) and permitting air to enter the compressor. Then the dome-relief-valve spring (25), no longer overcome by vacuum, closes the dome relief valve (22), preventing escape of air from the oil dome (15)—and the pumping cycle proceeds until a 100-pound pressure is again built up in the air reservoir.





How the compressor is lubricated

Air pressure within the compressor during both the pumping and nonpumping cycles, except at the air-escape port (13), is always lower than the air pressure in the oil dome (15). This pressure differential forces the oil from the oil reservoir (16) through an oil passage (26), an oil filter (28), and holes drilled in the rotor shaft (4). From these shaft holes (27) the oil is distributed uniformly over the endplates, rotor, and stator, serving not only as a lubricant but also as a seal to prevent the escape of air during the compression cycle.

The oil passes with the compressed air through the escape port (13), through the air duct (14) into the oil dome head (15) where the oil collects and drips into the oil reservoir (16), whence it is recirculated throu the compressor by the air pressure in the oil dome.

How the compressor is cooled

The operating temperature of the compressor is co trolled by three mediums: water, oil, and air. Wa is circulated through finned tubes (29) passing throu the oil reservoir, and on 10-cubic-foot-capacity co pressors water is also circulated through a water jac in the lower section of the stator. Oil in excess lubrication requirements is circulated by the oil system, the excess oil aiding in the dissipation of he Air flowing over the external surfaces of the co pressor also contributes to heat dissipation.

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N-A-X High-Tensile Steel center sills and other car shap provide more rugged construction for railroad cars. . . . Wi greater proven resistance to fatigue and impact at the wide ran of temperatures at which this equipment operates, N-A-X Hig Tensile Steel assures longer life with less maintenance co

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No other Special-Purpose Machine produces so much for so little

If you are interested in a time-tested ethod for getting maximum production lowest unit costs without sacrificing curacy, you will want to investigate the llard Contin-U-Matic Lathe.

Based on the well-known Bullard ver- al construction whereby work contin- usly rotates about the central column, is machine delivers a finished piece each ne one of the six or twelve spindles aches the loading station.

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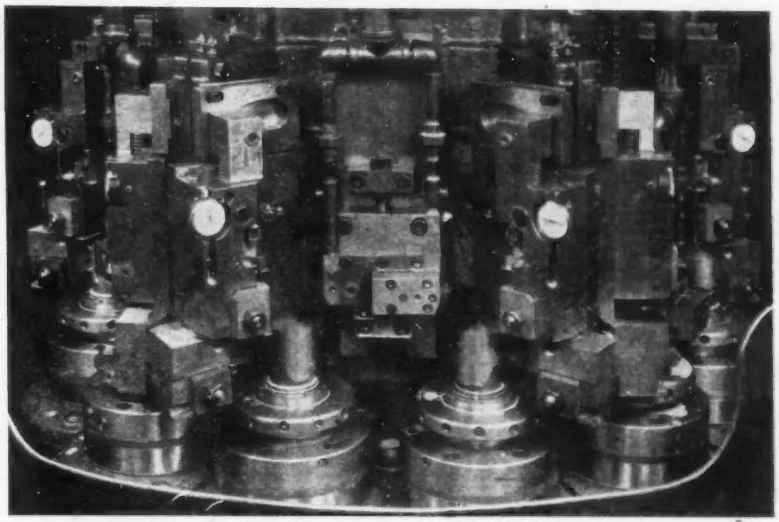
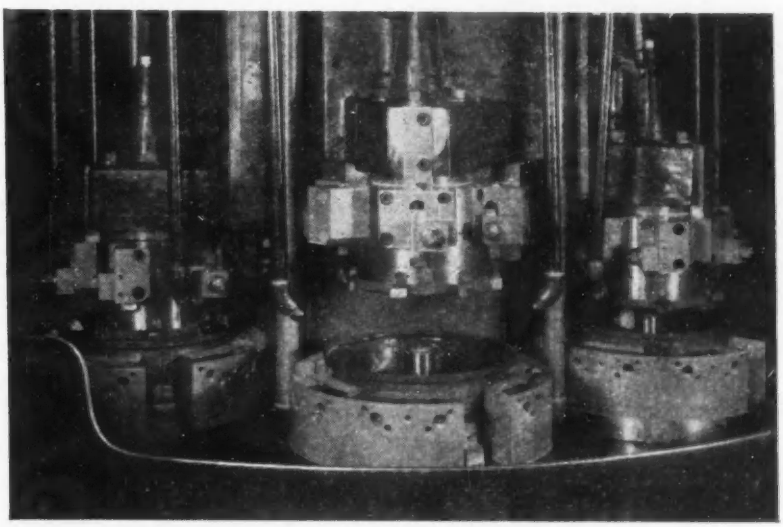
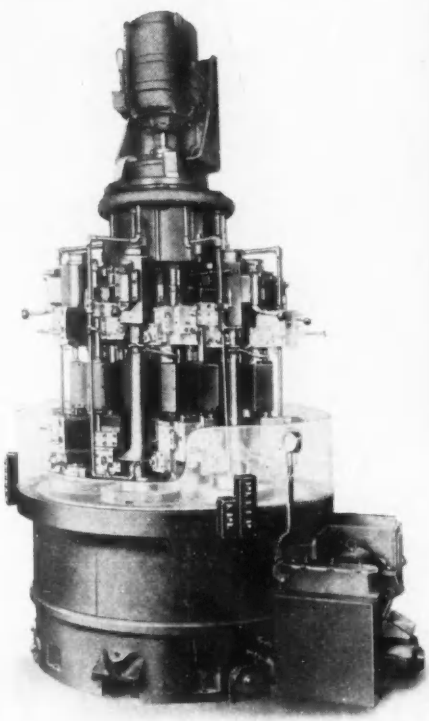
The Bullard Contin-U-Matic Lathe is ade in 14" and 20" sizes with six spin- es and in the 10" size with either six or elve spindles. Write today for complete formation. The Bullard Co., Bridgeport Connecticut.



Close-up of job being produced on 12-spindle Contin-U-Matic



Close-up of job being produced on 6-spindle Contin-U-Matic



Typical Bullard Contin-U-Matic Lathe

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CREATES *NEW METHODS* FOR MAKING MACHINES DO MORE

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SAVE TIME, TROUBLE, MONEY

Progressive tractor manufacturers, like many others in the automotive and aviation industry, find it far more economical to "wash their hands" of the intricate task of engineering and producing their own lighting and ignition wiring assemblies—and assign the job to Essex.

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So take a tip from men who know. If you use electrical wiring assemblies of any size or type, contact Essex. Its engineers are always available for consultation on any detail—from original design to final installation.

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Add SKF performance to power, comfort and economy advantages of the Oliver Row Crop 60 Tractor, and you account for the popularity of this tractor on small farm operations. The use of SKF Bearings on the transmission means constant smoothness, correct alignment, long gear life—freedom from the headaches and backaches resulting from bearing trouble. When the *manufacturer* makes an SKF-equipped product, he makes sales easier for his *dealers* . . . profitable performance available for his *customers*.

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SKF

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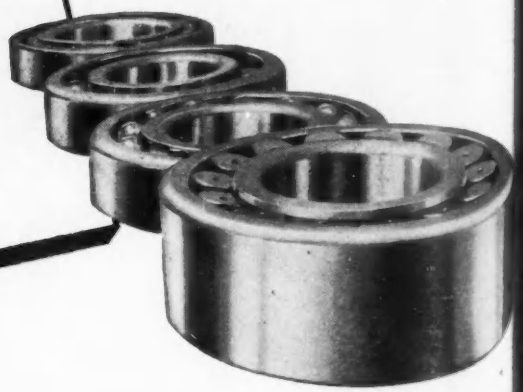

BOTH are Permite Castings. The one pictured at the top was cast in sand, and weighs 4 lbs. 6 oz. The other is a permanent mold casting of the same part, and weighs only 3 lbs. 10 oz. Because the initial order called for a limited quantity, sand castings were supplied. But later orders, in greatly increased quantities, justified a change to permanent mold.

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Permite modern foundries are equipped to give you high quality aluminum alloy castings of the type which best meets your needs. Prepare for increasing postwar competition by consulting with Permite engineers on your castings requirements. Your inquiry will receive prompt attention.

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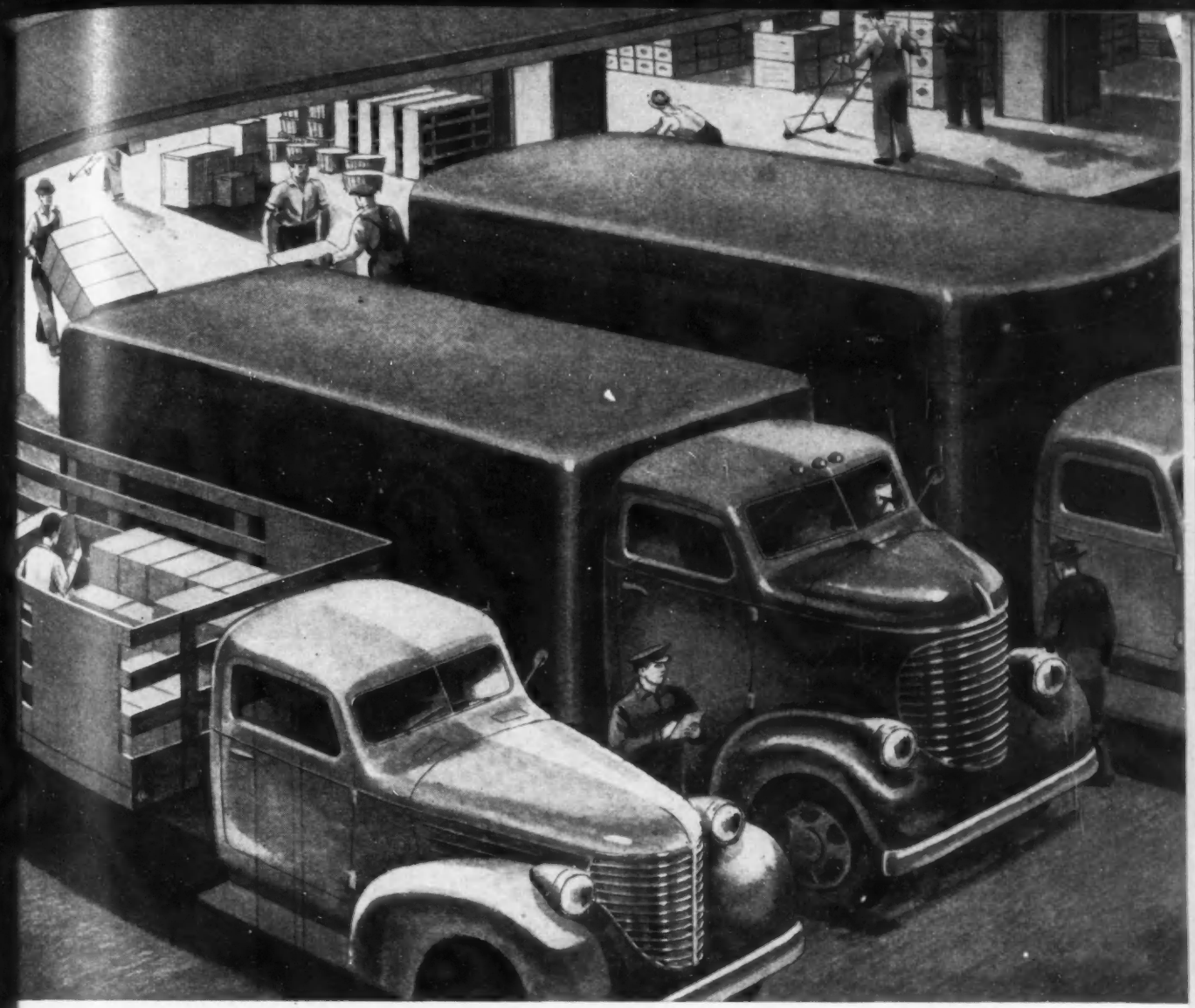
PERMITE ALUMINUM ALLOY CASTINGS



AIR BRAKES STOP 'EM ALL

Heavy or light, there's a genuine Bendix-Westinghouse Air Brake designed especially for every class of service. Naturally your business is different and Bendix-Westinghouse takes this into consideration when it offers a control tailored exactly to meet your individual requirements ★ Consult your local authorized Bendix-Westinghouse Distributor. He's an expert on braking problems whose service has proved invaluable to thousands of operators like yourself. His recommendations you can rely upon and it may surprise you to know that the conversion to genuine Bendix-Westinghouse Air Brakes will be to your distinct economic advantage. At any rate, it will pay you well to investigate this time tested power-to-stop which bears the unqualified endorsement of the nation's leading manufacturers and operators.

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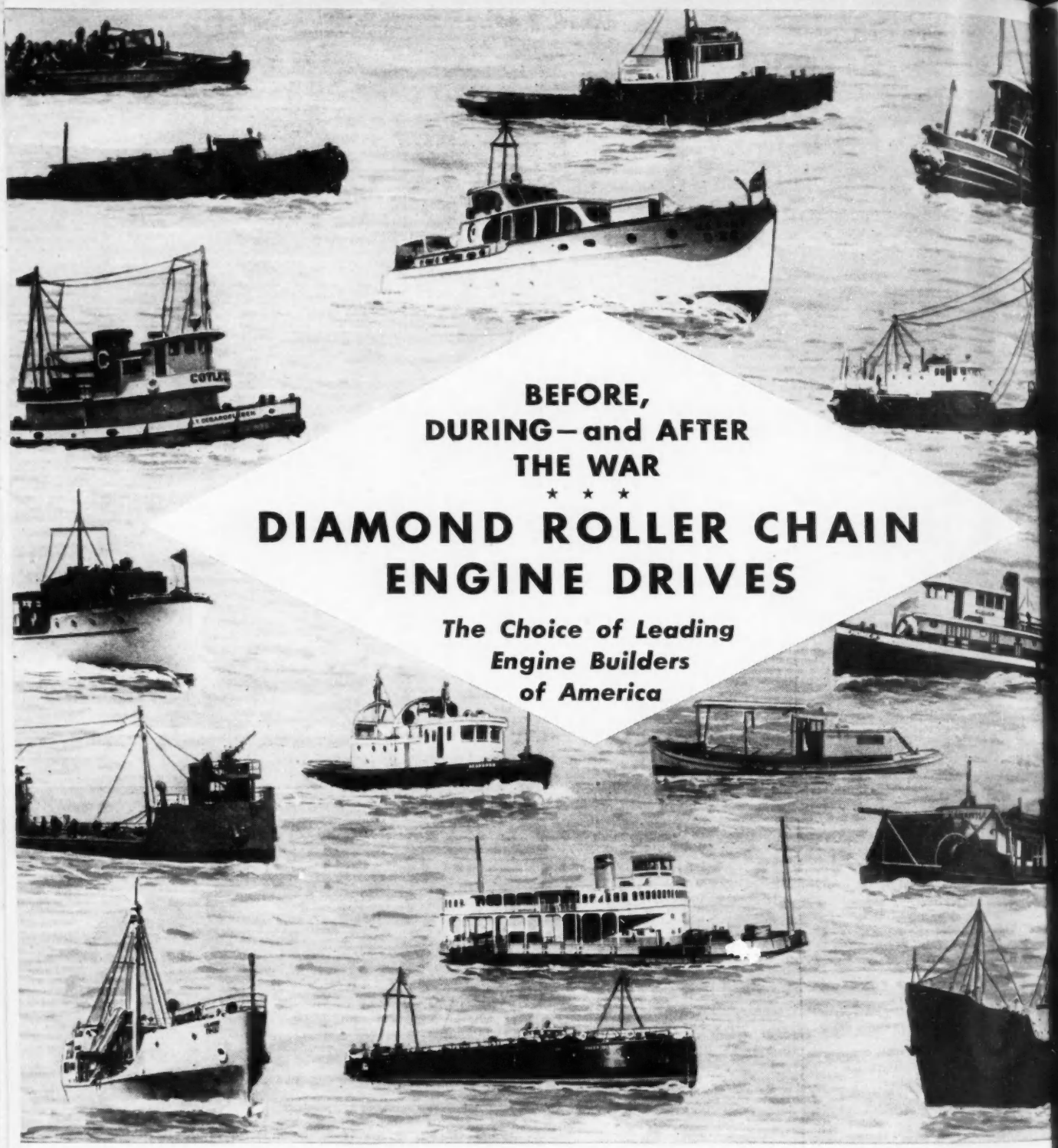

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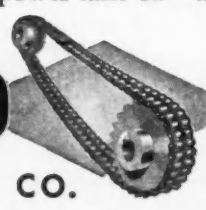
DIAMOND  **ROLLER CHAINS**

Write today for 96-page Chain Drive Catalog 617.

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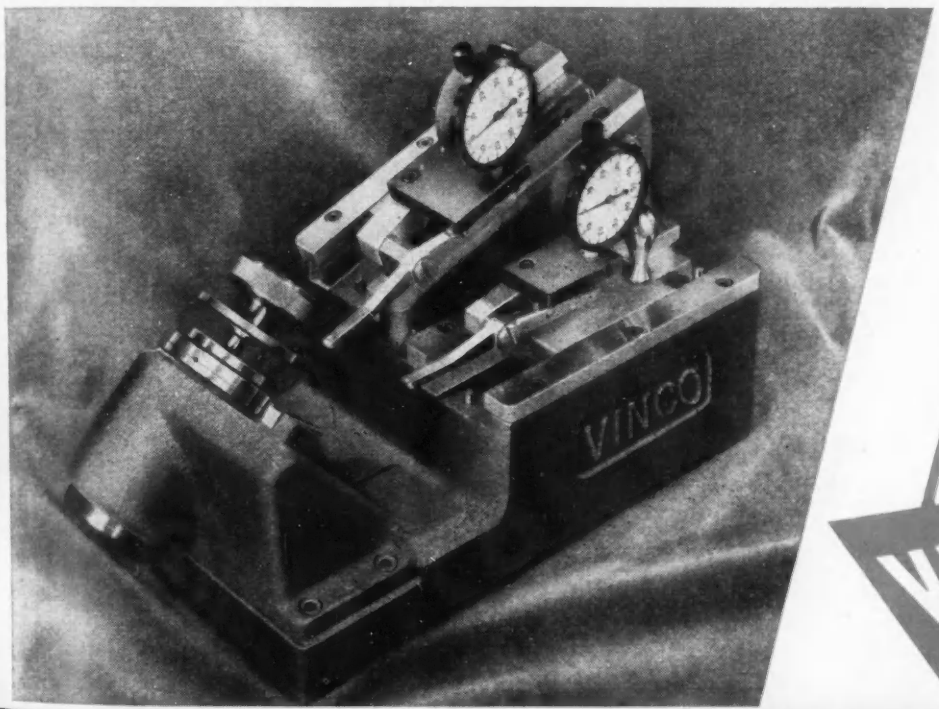
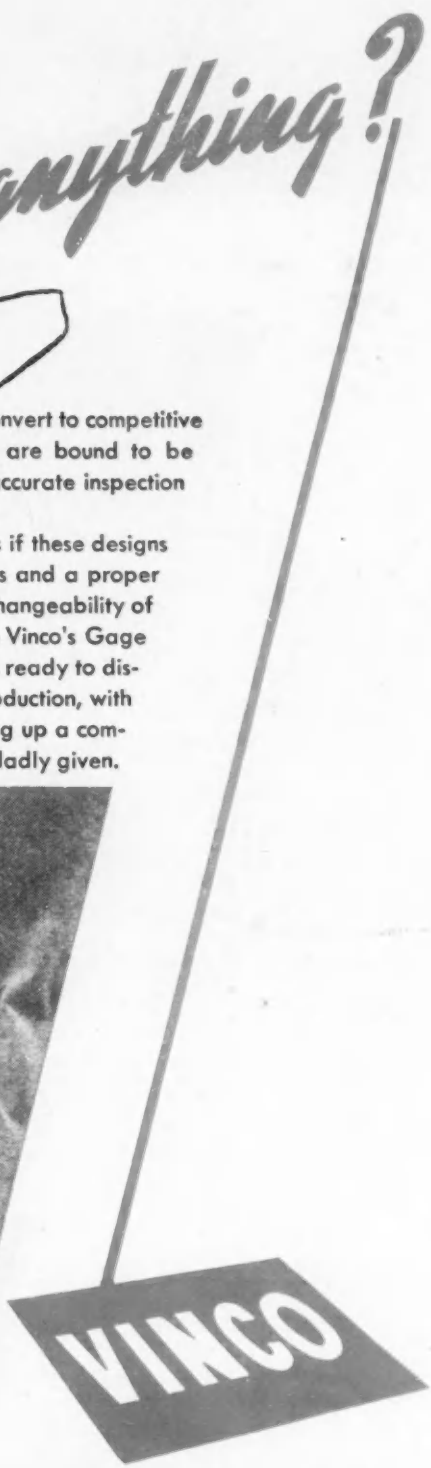
Have you forgotten anything?

In the mad rush to convert to competitive production, important items are bound to be overlooked. For instance: a comprehensive and consistently accurate inspection control of related parts, vitally essential to future quality production.

It is too apparent for comment that future designs will depend on precision parts if these designs are to function correctly. It is equally apparent that the selection of reliable gages and a proper over-all gaging method will play a large part in the correct assembly and interchangeability of parts. One way to insure this is to join the ever-increasing ranks of those who use Vinco's Gage Engineering Service when planning new production schedules. At all times, Vinco is ready to discuss the complete subject of gaging, together with the attendant problem of production, with your engineering staff. Our assistance to your engineers in establishing and setting up a complete and comprehensive gaging policy, suited to your individual needs, will be gladly given.





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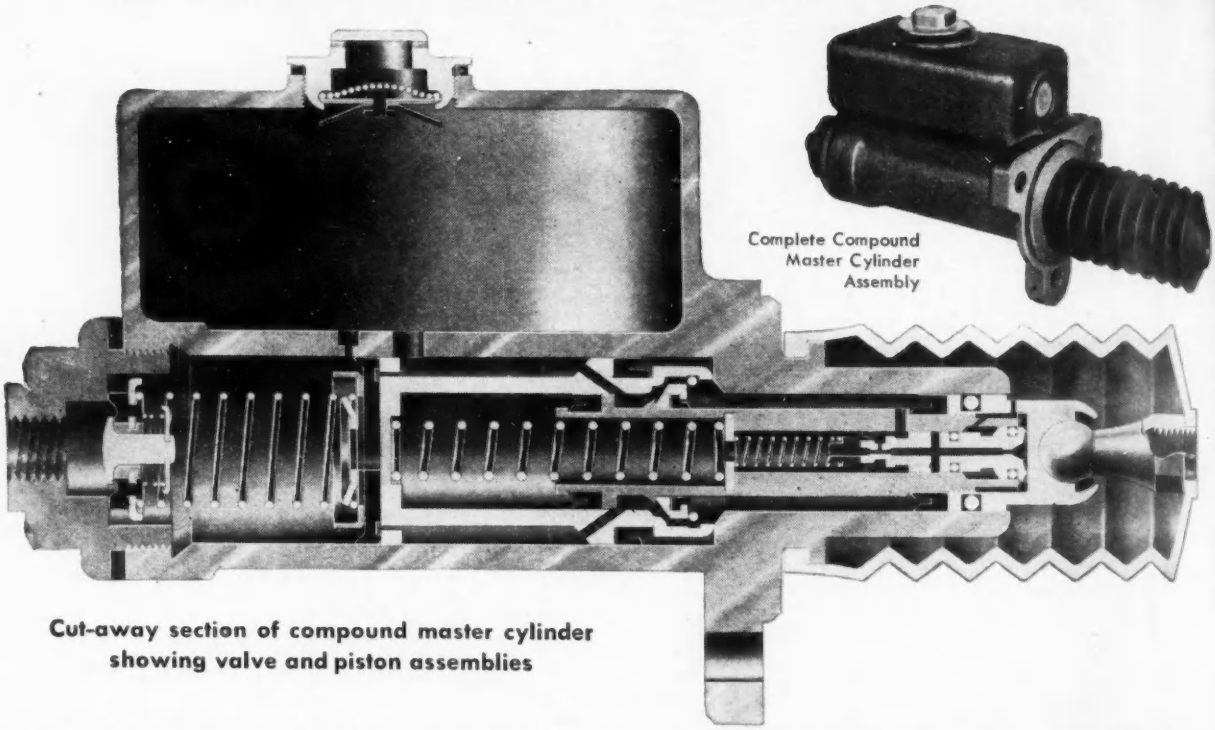
THE NEW YORK AIR BRAKE CO. *Announces*



Complete Compound Master Cylinder Assembly

Cut-away section of compound master cylinder showing valve and piston assemblies

BUILDING BRAKES IS OUR BUSINESS

For 55 years, this company has specialized in the engineering and construction of railroad brakes and is a recognized authority in brake application and design. In entering the automotive field, therefore, we contribute a technical experience unexcelled in the solving of difficult braking problems.

HYDRAULICS IS OUR BUSINESS

Our Hydraulic Division, expanded by production for war, has applied HYCON hydraulic systems to the actuation and control of a wide range of military planes and industrial operations and products.

"HYCON *actuation and control*" are now available for power brakes for trucks and busses.

Controlled BRAKING, *Completely* HYDRAULIC

The new HYCON Truck Brake is a *compound master cylinder* designed to furnish perfect brake control and correctly measured power without the use of vacuum, air or other auxiliary means. Five years of research, development and tests have proven the efficiency and economy of its radically advanced principles. Reports from exhaustive road tests starting early in 1941 show:

Substantial savings in gasoline consumption. Unlike existing types of power brakes, compound cylinders operate independently of the motor and the carburetor can be adjusted to maximum idling efficiency.

Increase in tire mileage as much as 20% due to elimination of over-braking.

Fewer brake adjustments; no maintenance beyond that required by standard type master cylinders.

Simplified installation reduces cost of application.

THE NEW YORK AIR BRAKE COMPANY

HYCON *Compound Master Cylinder* FOR TRUCKS & BUSSES

Eliminates "Booster" Brake

The secret of *controlled braking* in HYCON Truck Brakes lies in a second piston in the compound master cylinder, which eliminates the necessity for vacuum-air-actuated "booster" brakes. The single HYCON Unit performs hydraulically the combined operations now actuated by fluid, vacuum and air . . . gives more constant, more positive braking control.

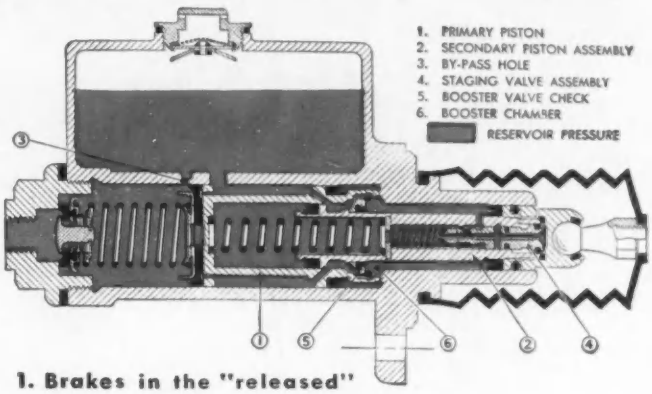
With the HYCON Unit, the hydraulic pressures are in direct proportion to pedal pressures. The correct amount of power is always available to meet load or no-load conditions. Since it eliminates the *lag* required for the atmospheric pick-up on vacuum brakes, it will stop vehicles more quickly.

IMPROVES SAFETY FACTOR

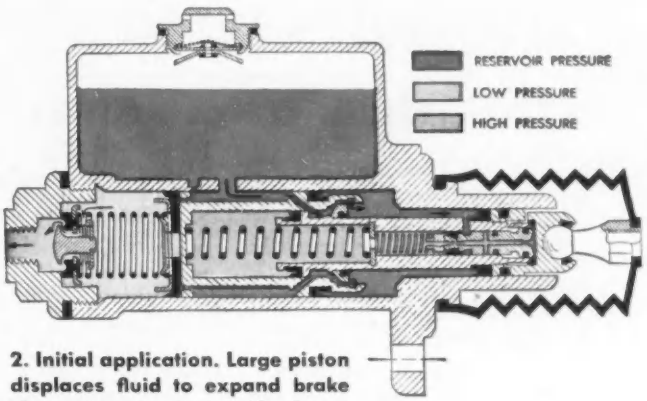
An important safety factor develops from the HYCON principle of a compound cylinder—quicker stopping; better control. HYCON Truck Brakes offer worthwhile savings; you save in fuel and tire consumption, and in maintenance. The unit occupies no more space on the chassis than the original equipment master cylinder; requires no additional tubing, no holes to drill, and can be installed within an hour.

SEND FOR DEMONSTRATOR UNIT

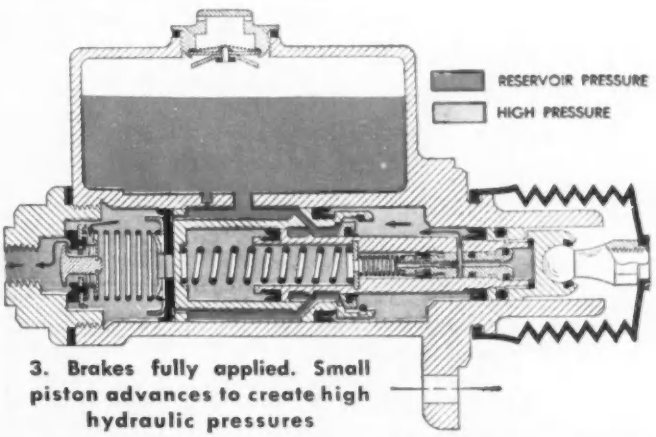
HYCON Truck Brakes are now available to replace 1¼" and 1½" Di. original equipment master cylinders. Order a demonstrator unit from your local power brake distributor, or write direct to The New York Air Brake Company, 420 Lexington Avenue, New York 17, N. Y.



1. Brakes in the "released" position



2. Initial application. Large piston displaces fluid to expand brake shoes into contact with drums



3. Brakes fully applied. Small piston advances to create high hydraulic pressures

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3 Public demand for Fram demonstrates that in use, as in the laboratory, Fram oil filters give unsurpassed performance.

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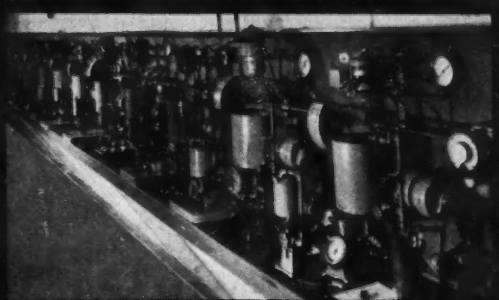
Now Available for civilian use, the amazing Fram Filcron cartridge and the new Fram filter have demonstrated their high efficiency in wartime use on both Army and Navy engines.



Engineers Are Invited to make use of Fram laboratories in conducting filtration tests for present or postwar engines. The new Fram filtration laboratories are the most modern in America.

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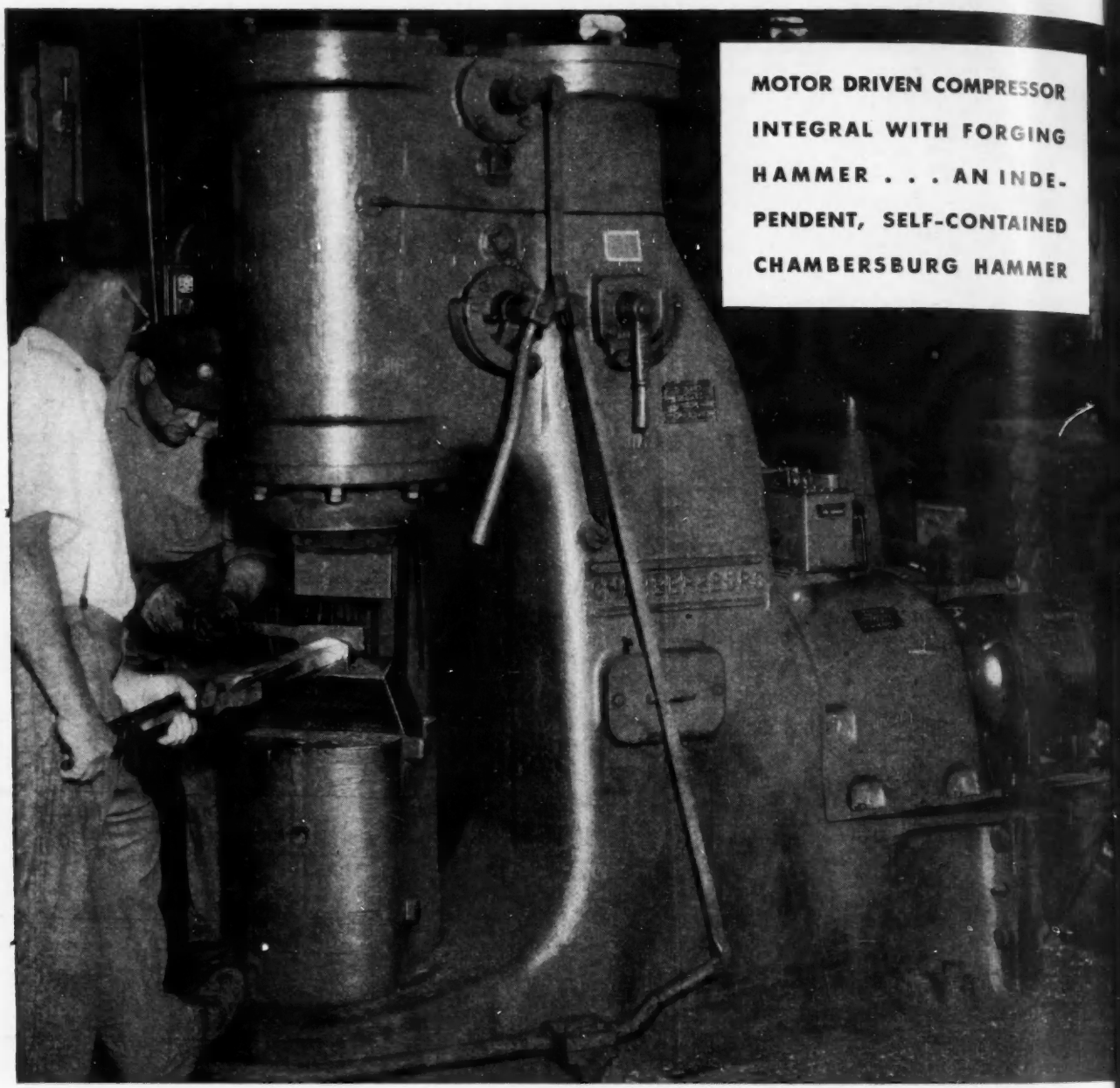

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Now You Can Do Forging Right in Your Own Plant

Independent of steam or air lines, the Chambersburg Pneumatic Hammer may be placed wherever convenient in the plant. It is ready to operate as soon as the motor is up to speed, delivering its constant rhythm of blows, heavy or light, at the will of the operator. It will forge faster . . . better . . . at a higher temperature . . . because of higher impact speeds, heavier anvil construction and more powerful blows. It was designed with just that objective in view—to make *better* forgings faster, to work the forging at higher temperatures and to produce the forging with the least possible operating expense. The success of this objective is attested by the increasing popularity of this hammer.

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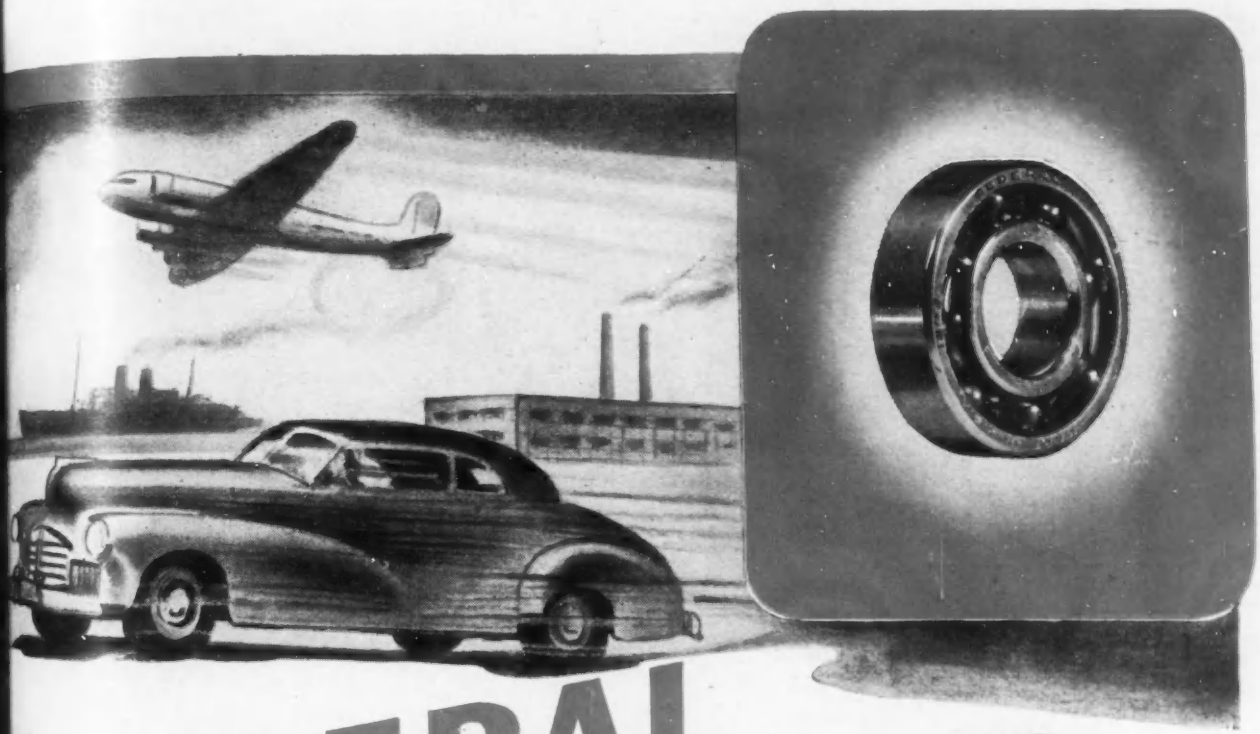

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Here is a compact, light-weight ball bearing that is setting the pace in many different industries. Hundreds of thousands of this Federal Type 1206 are being installed in automotive generators, electric motors, small electric lighting plants and similar products.

Used in vast quantities by American manufacturers previous to the war, Federal Type 1206 later served our armed forces on every battlefront,—a little giant among ball bearings now available for peacetime service.

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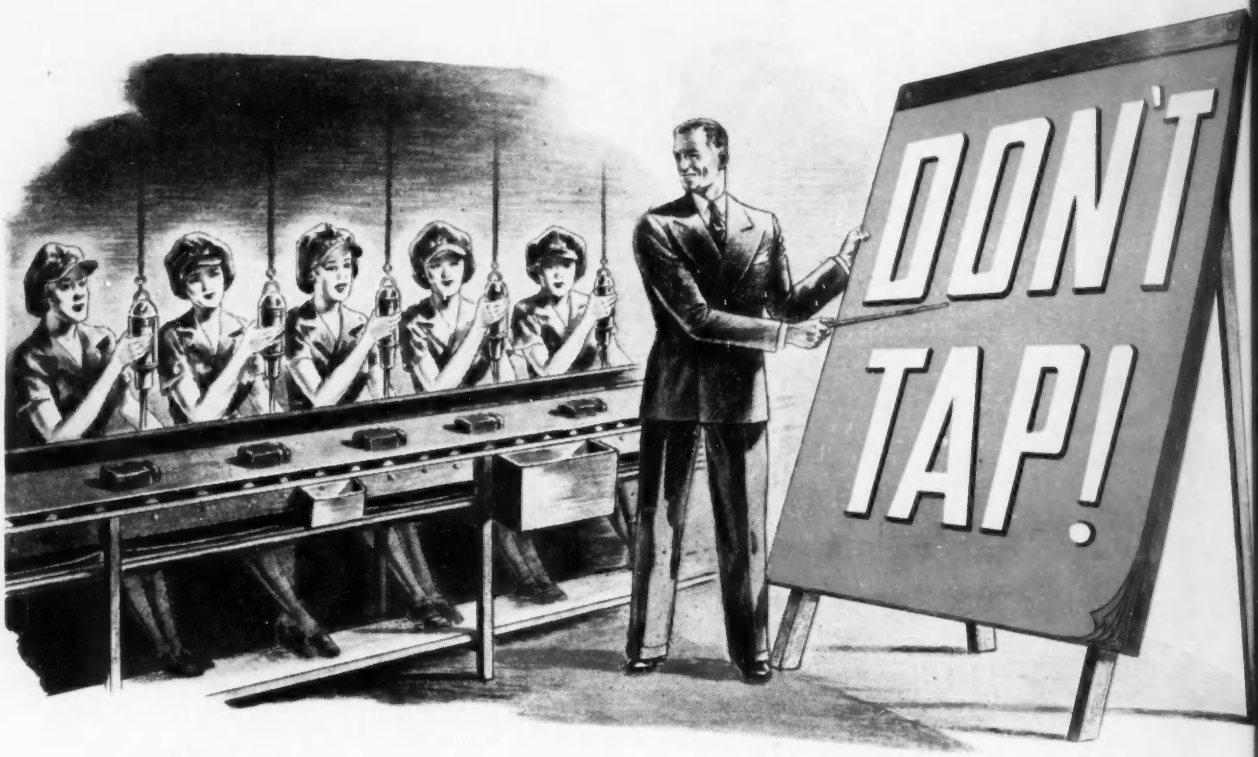

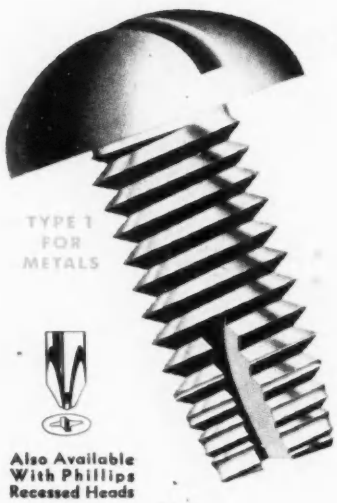

Also Available With Phillips Recessed Heads

SAVE TIME . . . REDUCE COSTS . . .
ASSURE TIGHTER FASTENINGS WITH

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● **Don't tap . . . it wastes time . . . it's unnecessary! Shakeproof Thread-Cutting Screws cut their own clean thread into metals of any thickness, eliminating taps and tapping operations. A snug, tight fit is always certain, and better product performance is assured.**

Let Shakeproof Engineers recommend the type and method of fastening that is best suited to your product and assembly line requirements. Write today for the consultation of a field engineer.

FREE!
Get free test kit. Contains a variety of samples in many types and sizes. Write for Kit No. 22.

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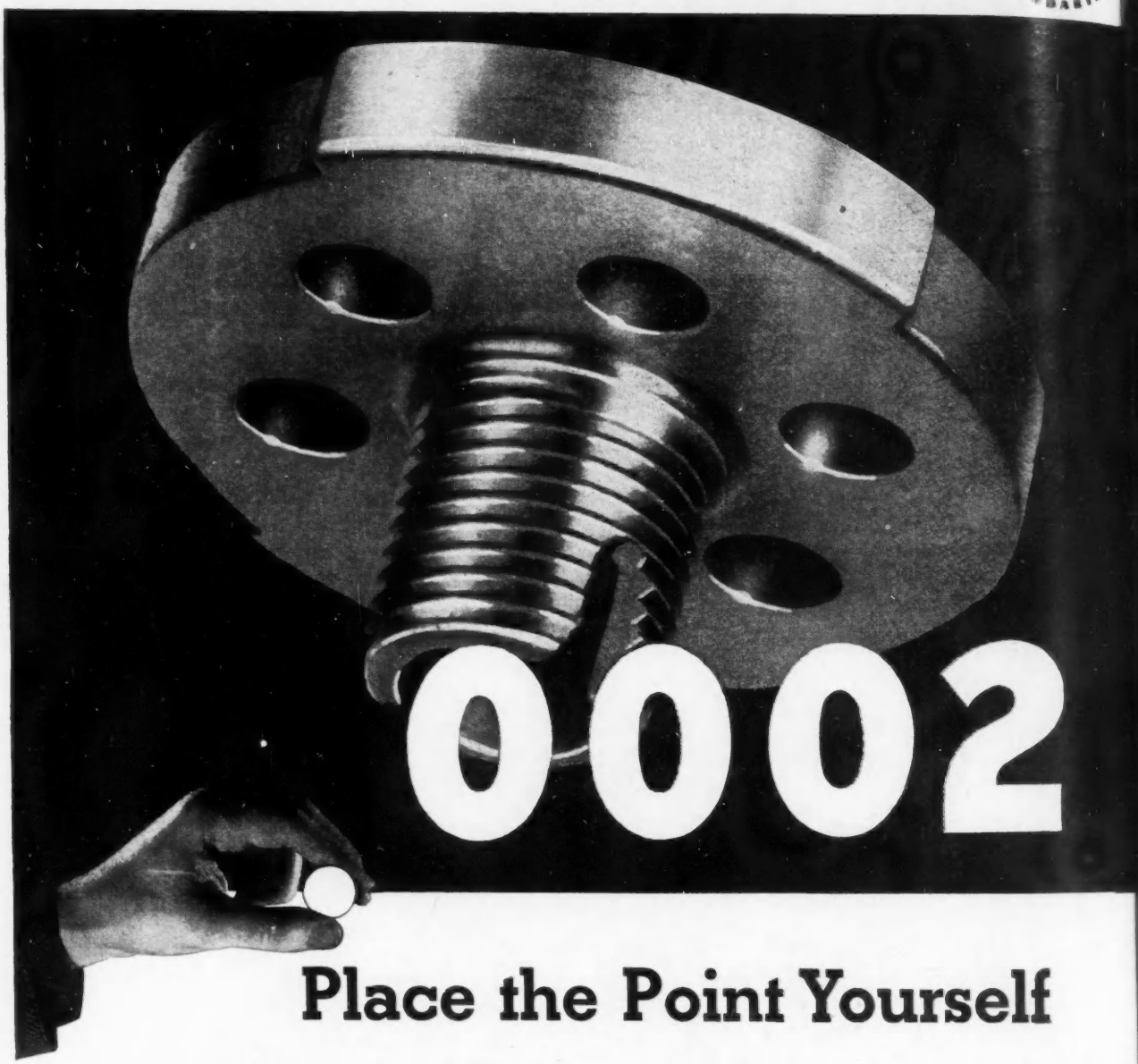
SPECIAL COLD FORGED PARTS • STANDARD CAP SCREWS • HARDENED AND PRECISION GROUND PARTS • SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC MOLDS • SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES



Place the Point Yourself

Whether your need is for hardened and precision ground parts to tolerances of two-tenths of an inch or two ten-thousandths of an inch, insist on an Allied product. During peace and war Allied's hardened and precision ground parts in *production quantities* have been a standard of quality in mass production industries. Today Allied's four superbly-equipped plants offer greater service than ever to manufacturers in the radio, home appliance, plastics, aviation, furniture, electrical, farm implement and other mass production fields. And mature business experience, economical production and deliveries *on time* make Allied service part of the firm foundation that manufacturing enterprises must have to bid for and hold quality markets. Write Allied today. This will entail no obligation. Allied engineers are always at your service.

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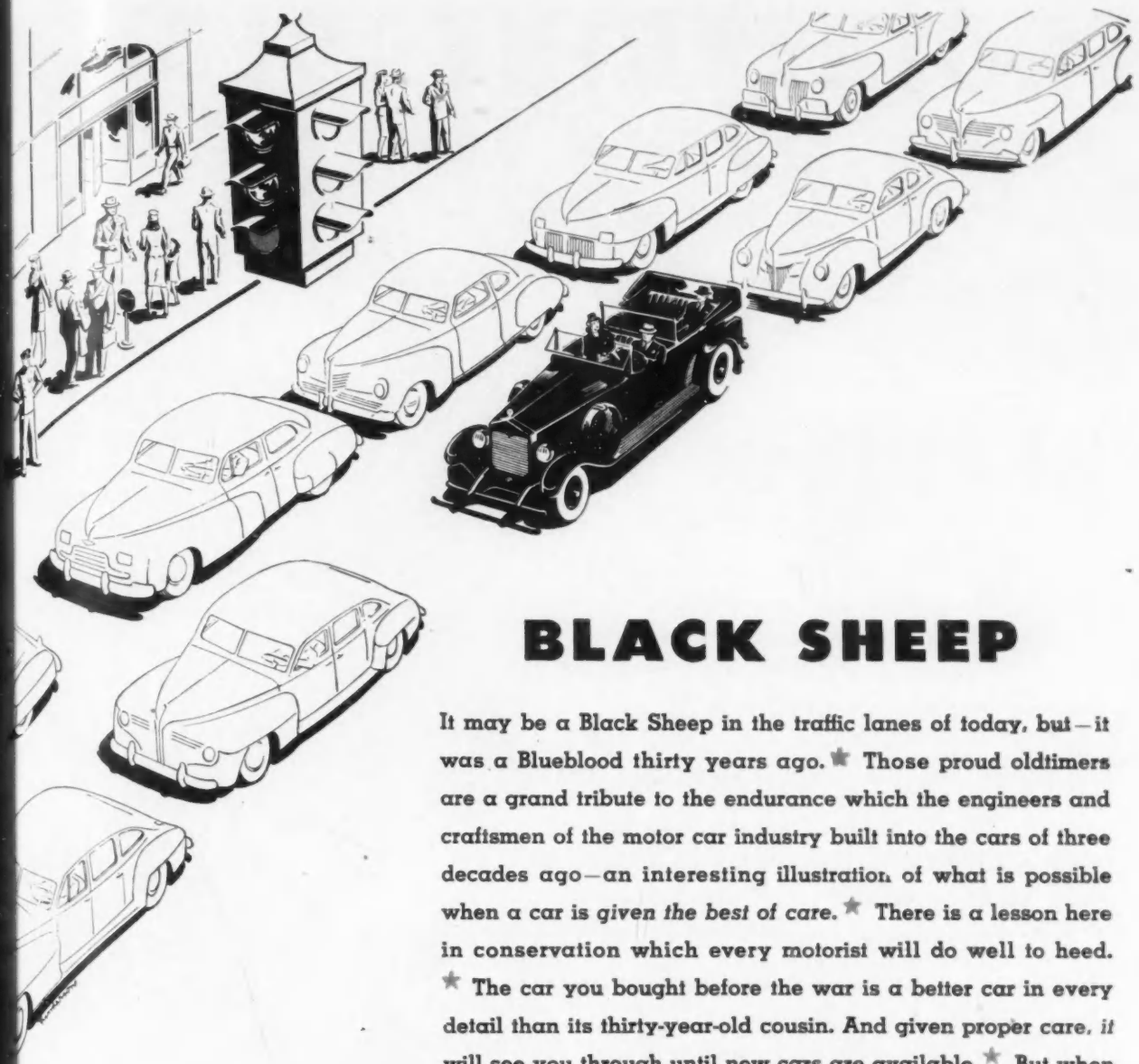

BLACK SHEEP

It may be a Black Sheep in the traffic lanes of today, but—it was a Blueblood thirty years ago. ★ Those proud oldtimers are a grand tribute to the endurance which the engineers and craftsmen of the motor car industry built into the cars of three decades ago—an interesting illustration of what is possible when a car is *given the best of care.* ★ There is a lesson here in conservation which every motorist will do well to heed. ★ The car you bought before the war is a better car in every detail than its thirty-year-old cousin. And given proper care, *it* will see you through until new cars are available. ★ But when you *are* able to buy your next car, you'll find still finer styling, still better operating efficiency, new ideas in design, higher standards of precision, and better all-round performance. ★ *Automotive engineers are constantly improving the transportation of America.* It is a privilege to have worked so closely with these men through two wars and the years between.

For many years every motor car and truck built in this country has contained one or more Eaton-built parts.

EATON

EATON MANUFACTURING COMPANY • *General Offices:* CLEVELAND, OHIO

PLANTS: CLEVELAND, DETROIT, SAGINAW, MARSHALL, BATTLE CREEK, LAWTON, VASSAR MASSILLON, WINDSOR (CANADA)

SUPPLIERS OF *FINE PRECISION PARTS TO THE AUTOMOTIVE AND AIRCRAFT INDUSTRIES FOR MORE THAN THIRTY YEARS*

ENGINEERING DESIGN SERVICE *for* *Silent* SLEEVE BEARINGS

You can simplify your sleeve bearing design problems — without cost or obligation — by using our engineering consultation service. Fully equipped engineering and research departments are at your disposal.

We operate six manufacturing plants, each specializing in sleeve bearing manufacture within a specific range of size and alloy combinations. Facilities are available for both large volume production and small runs, consistent with your cost requirements.

Thrust washers and precision bronze bearing parts, and large bearings (up to 27" diameter), a specialty. Your inquiries are invited.

FREE: Handbook of Sleeve Bearings

A practical guide for engineers, draftsmen, in bearing design specification. Its use reduces major tooling costs, design and production time. A request on your company letterhead will receive prompt attention.

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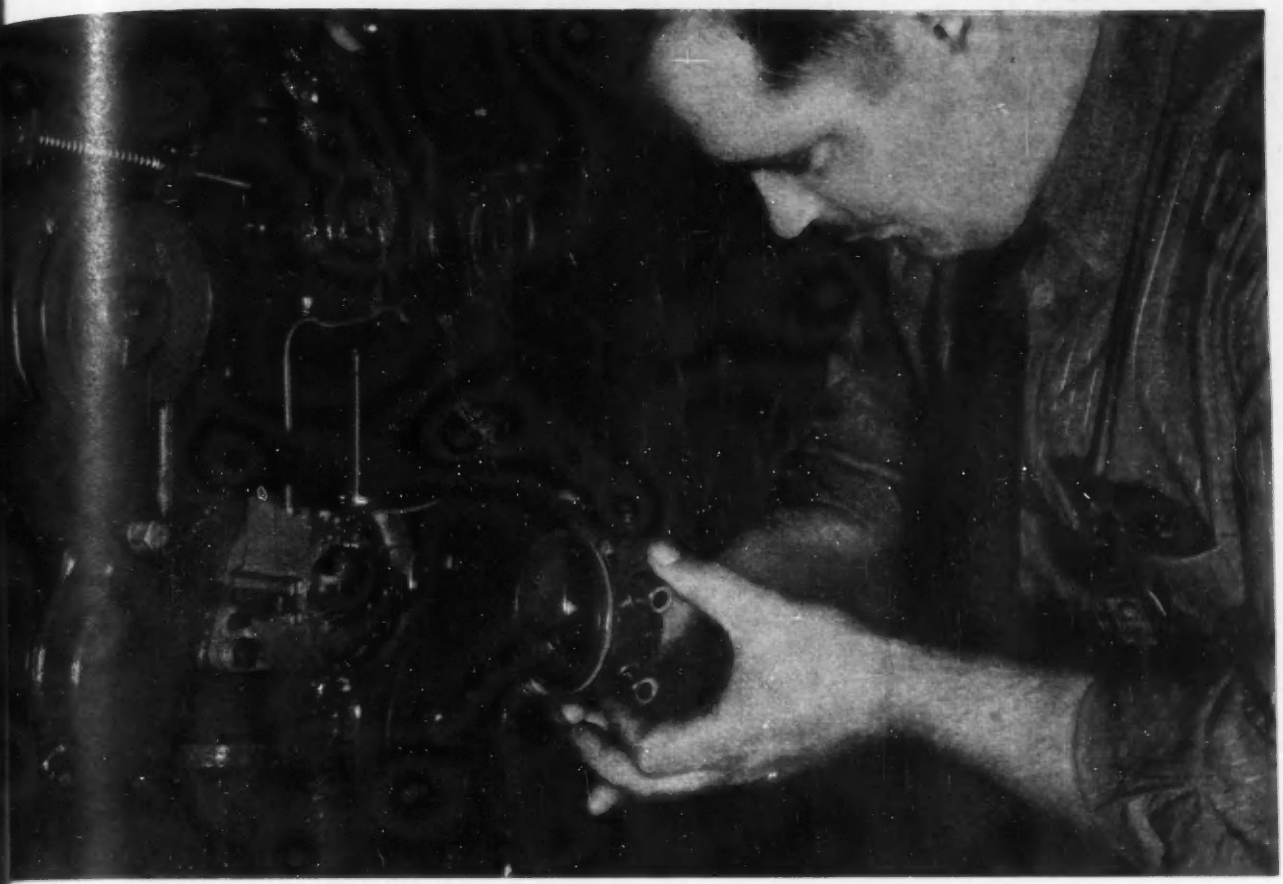
Silent FEDERAL Mogul SLEEVE BEARINGS



Melmac* *plastic... timing factor for a Tractor*

From the moment this molded MELMAC plastic distributor cap is snapped into place, a Ford-Ferguson tractor is off to a good start. Delivery of accurately timed, positive, high-tension spark through the distributor is assured. When the tractor goes out into the field it is ready to operate under unusually tough conditions. Because of MELMAC's sturdy insulating properties, flashovers and shorts caused by dust, dirt, and dampness do not scorch conducting paths across the distributor cap. This all-important piece of mechanism delivers a "hot" spark, without leakage, to insure perfect timing.

Mineral-filled MELMAC, the high-arc-resistant plastic, has been developed by Cyanamid for distributors, magnetos, and other electrical parts. Its high heat resistance, non-inflammability, and resistance to arc tracking under the most severe conditions, mean uninterrupted performance, longer life, and improved serviceability of electric equipment.

Complete information on this specialized industrial plastic is contained in the handbook, "MELMAC MOLDING COMPOUNDS," which will be sent you on request. We shall also be glad to work directly with you on putting MELMAC to work to meet your dielectric needs.

*Reg. U. S. Pat. Off.

MELMAC 592

Mineral-filled Molding Compound offers an unusual combination of electrical and physical properties to meet new needs.

Typical Properties

Dielectric strength . 430 volts/mil.
Arc resistance . . . . . (ASTM) avge. 130 sec.
Heat resistance . . . . . 300° F.

AMERICAN CYANAMID COMPANY
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Cyanamid Plastics

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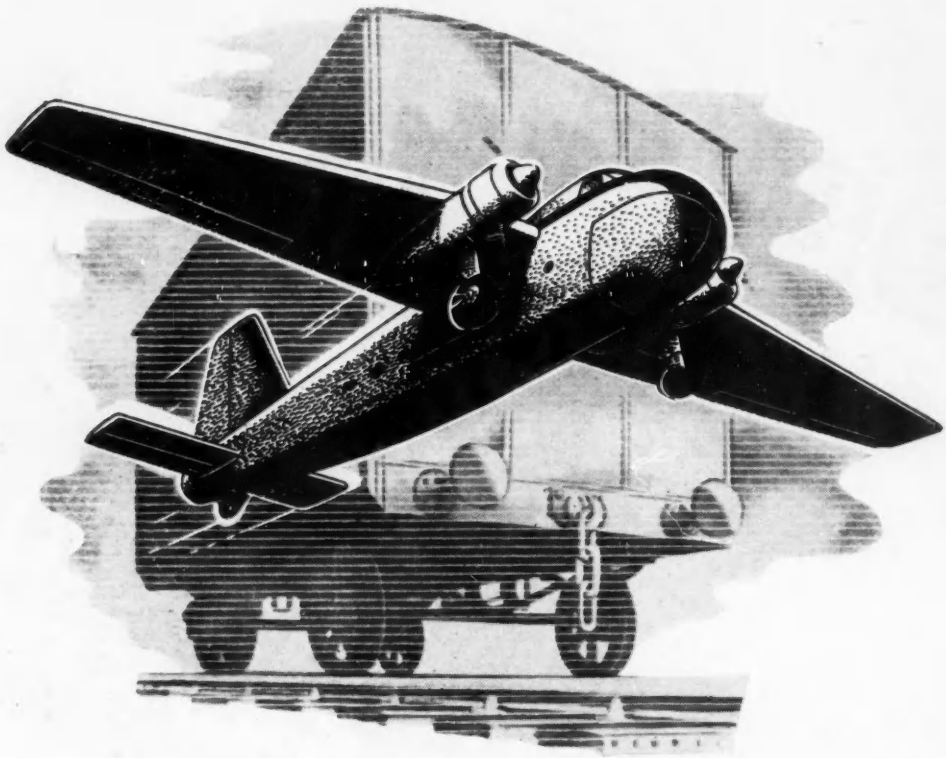
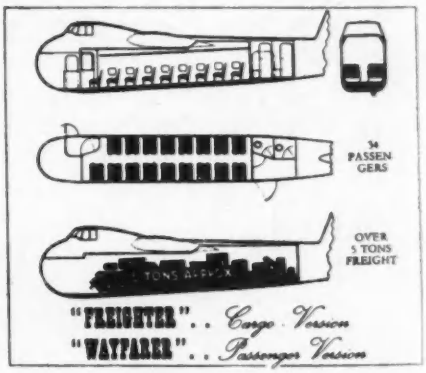


THE "BRISTOL" FREIGHTER . . .

Goods wagon of the sky . . .

The "Bristol" Freighter . . . an aircraft designed for freight-carrying and popular passenger travel at rates which place air transportation within the financial range of an entirely new strata of potential users. The essentials of operational economy, low maintenance, and adaptability governed its conception, design and construction, resulting in an efficient "brass tacks" aircraft for low-rate freight and passenger travel. The Bristol Aeroplane Company Limited.



"Bristol" *built-to-a-purpose aircraft*

Let's talk about REAL RUGGED SERVICE

The shocks from starting heavy loads in soft footings, and the strains of hauling them over unimproved roads are rigid tests of a truck's transmission. In this service Fuller Transmissions are supreme. Wide-faced, shot-peened gears with overlapped and crowned shaved teeth accept abuse, reduce maintenance and in consequence assure lower operating costs. The smooth shift, up or down wins the instant approval of the operator. These are some of the reasons why you find so many Fuller Transmissions in large, off-the-highway units.

Fuller TRANSMISSIONS

FULLER MANUFACTURING COMPANY, TRANSMISSION DIVISION
KALAMAZOO, 13F, MICHIGAN
Unit Drop Forge Division, Milwaukee 1, Wisconsin

AIR — LAND — SEA

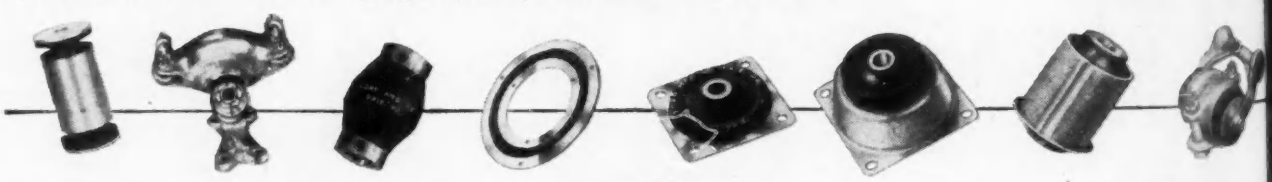
Radio, electronic and radar equipment is necessarily delicate in construction and necessarily precise in its functioning. The enormous recent advances, first made on paper, when translated into practice have almost invariably run into one major difficulty . . . vibrational interference.

So, Lord, pioneer and leader in subduing the harmful forces of vibration, has been called upon for a wide range of applications in this field. Where possible, outside vibration forces have been isolated at their source; vibration of component parts has been controlled; and delicate parts and instruments have been protected from outside interference by isolation.

Lord engineers, the most experienced in the field of vibration, have access to the greatest file of experimental data and case studies of practical experience in existence, and they have the largest assortment of mountings, all of exclusive Shear Type Bonded Rubber and every one engineered for the specific conditions it has to meet.

The safety of passengers in the air, on land and sea; the pleasure of large audiences; the enjoyment of radio and television at home; all depend on the efficiency of communication systems, an efficiency which has been accomplished and continues to be promoted by constant consultation with Lord, HQVC (Headquarters for Vibration Control).

LORD
SHEAR TYPE
Bonded Rubber
MOUNTINGS



IT TAKES BONDED RUBBER *In Shear* TO ABSORB VIBRATION

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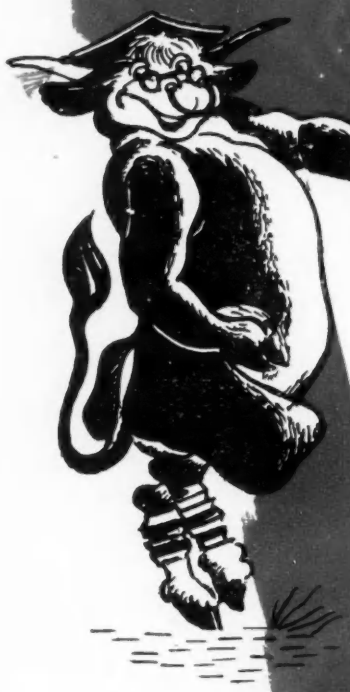
Originators of Shear Type Bonded Rubber Mountings

Every genuine Lord Mounting carries the name "LORD" embossed in the rubber or in raised letters on the forgings.


nothing smoother
OWER ROLLER BEARING COMPANY

MR. ENGINEER....

IF YOU NEED ANY COMBINATION OF THESE REQUIREMENTS IN PLIABLE PARTS, SIRVENE CAN SOLVE YOUR PROBLEM



Resistance to-

oils, greases, acids, alcohol, other solvents, sunlight, ozone, gases, air pressure, extremes of temperature, abrasion.

Assurance of-

maximum flexibility or rigidity, good compression set, flame proofness, high tensile strength, high resilience, micrometric precision, flaw-free uniformity.

Under conditions of-

high or low speeds, hermetically sealed or exposed to dust, mud, weather, subzero temperatures, precision operation or toughest service conditions.

GIVE YOUR SPECIFICATIONS TO SIRVENE ENGINEERS

and, if it is humanly possible to do so, they will develop a pliable part to meet your needs. Since 1929, when Chicago Rawhide instituted its research program in the development of compounded elastomers, Sirvene engineers have perfected many hundreds of pliable parts for use under seemingly impossible conditions. They can do the same for you. The vast amount of knowledge and experience which they have accumulated as a result, is available for the solution of your particular problem.

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THE *SCIENTIFIC* COMPOUNDED ELASTOMER

A Product of the Synthetic Rubber Division

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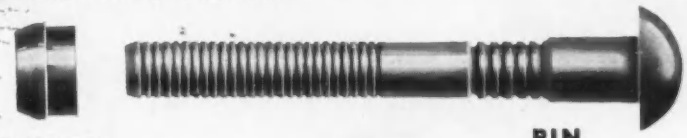
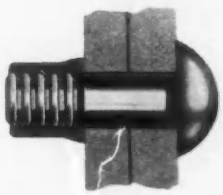
FOR FASTER, PERMANENT ASSEMBLY

...it's the *Huck* LOCKBOLT



COLLAR PIN



SECTION THROUGH DRIVEN HUCK LOCKBOLT

A COMPLETELY *New* TYPE OF FASTENER OFFERING MANY UNIQUE ADVANTAGES

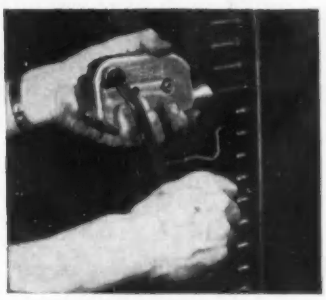
Neither a bolt nor a rivet, the Huck Lockbolt combines the advantages of ***both*** of these fastening devices and offers definite advantages over each. It's more quickly installed than a bolt—pulls the work tightly together before locking—fills the hole completely when required for maximum strength and rigidity—and fastens ***permanently*** without the use of lockwashers, cotterpins or special nuts. Tensile strength is comparable to that of bolts, shear strength equals or exceeds that of conventional rivets, and liberal hole size tolerance is allowed.

HOW IT'S APPLIED The pin is inserted from the back side of the work, the collar is slipped onto the pin, and the driving gun is applied to the pull grooves in the projecting end of the pin. Then, in rapid succession, the gun squeezes the work together between the collar and the head of the pin, wire-draws the pin to a press fit in the hole when hole filling is required, swages the collar into locking grooves in the pin, breaks the pin off flush with the collar, and frees itself from the swaged collar.

Thus the Lockbolt, after accomplishing a bolting-up operation, becomes the equivalent of a rivet, forming a rigid and permanent fastening. Either a hand-operated or a pneumatic gun can be used, as illustrated.

MATERIALS AND SIZES AVAILABLE Huck Lockbolts are available in two types—(1) for applications requiring hole filling (to replace rivets and close-fitting bolts), and (2) to replace bolts in clearance holes. They are furnished with heads of any type desired, and with pins of 24ST aluminum alloy, carbon steel, or high-strength alloy steel. Lockbolts are now available in 3/16" diameter with grip lengths ranging from 1/32" to 21/32" by 16ths. Lockbolts of 1/4" and 5/16" diameter will soon be available.

This DIFFERENT type of fastener may save both time and money on YOUR assembly jobs, whether special or every-day—production or maintenance. Investigate its possibilities! Further information on request.



Small hand gun is ideal for maintenance jobs. Six to 10 Lockbolts per minute can be driven with this tool.

The fast, light-weight pneumatic gun will drive from 20 to 40 Lockbolts per minute and is recommended for production work.

For applications where the back side of the work is *inaccessible*, HUCK BLIND RIVETS may be the answer. Bulletin 451 gives full details; may we send you a copy?

Huck **MANUFACTURING CO.**

480 BELLEVUE AVENUE DETROIT 7, MICHIGAN

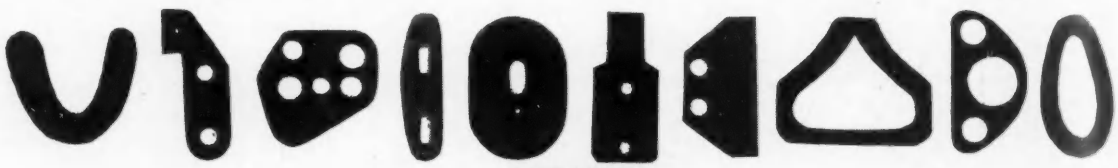
YOU'LL NEVER GET A KICK OUT OF THIS!

The man with the shotgun was plenty tired of the drubbing his shoulder took every time he fired. Then his dealer sold him a recoil pad of resilient Spongex* cellular rubber!

It was the old story of the thump and rattle and jar that wears on both product and owner . . . the cause of premature old age in products —from vacuum cleaners to automobiles. If you've been hunting for a shock absorbing material that will make your product vibration-free, more salable—think of Spongex.

The way it goes in and licks any number of tough product problems has spread its use into hundreds of applications for cushioning, sealing, insulation, sound dampening, gasketing, protection against dust, moisture, gases. Can be made in sheets, pads, slabs, cord, tubing, strips, molded forms and die-cut shapes.

We are operating at peak capacity on industrial production and may not be able to produce what you need for some time—perhaps not until crude rubber is plentiful. However, if your need is urgent, write us and we shall try to help you. Sponge Rubber Products Company, 102 Derby Place, Shelton, Conn. Sales Offices: New York, Chicago, Detroit, Washington.



SRP

SPONGE RUBBER PRODUCTS CO.

SPONGEX* CELL-TITE* *TRADE MARK REG U.S. PAT. OFF. TEXLITE TEXLOCK

A Quartet That's HARD TO BEAT

The Twin Disc Standard Line of Friction Clutches and Hydraulic Drives provides an unexcelled quartet of values:

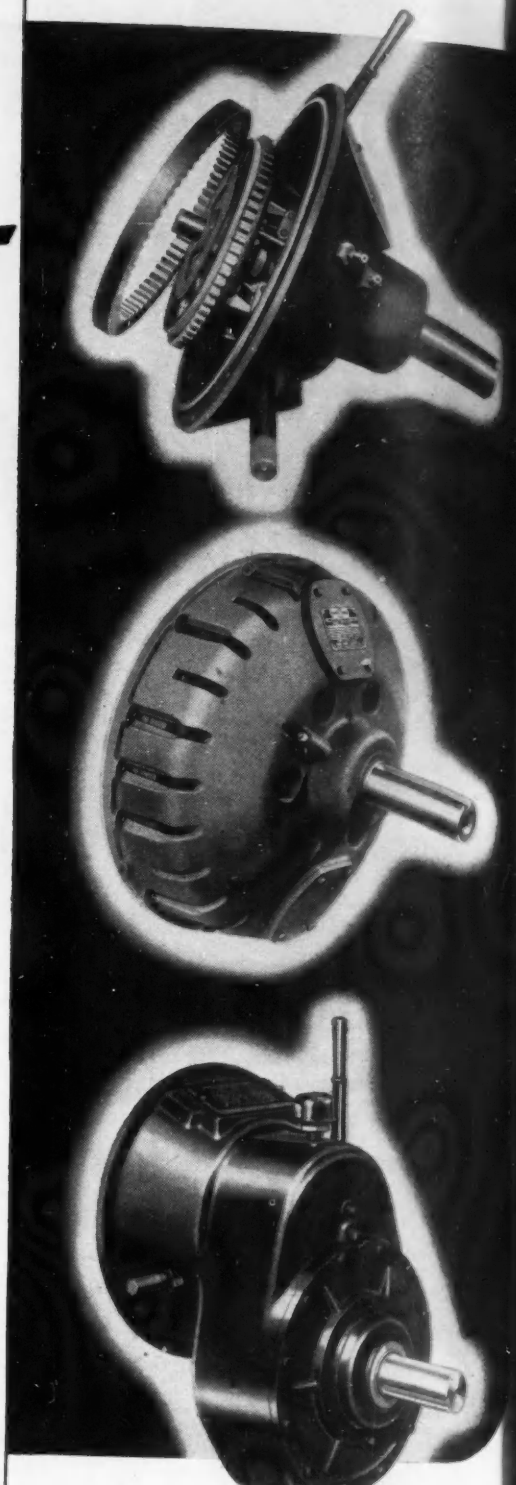
Mechanical Adaptability covers the widest variety of industrial applications.

Established Performance is backed by well established operating records in all major industries.

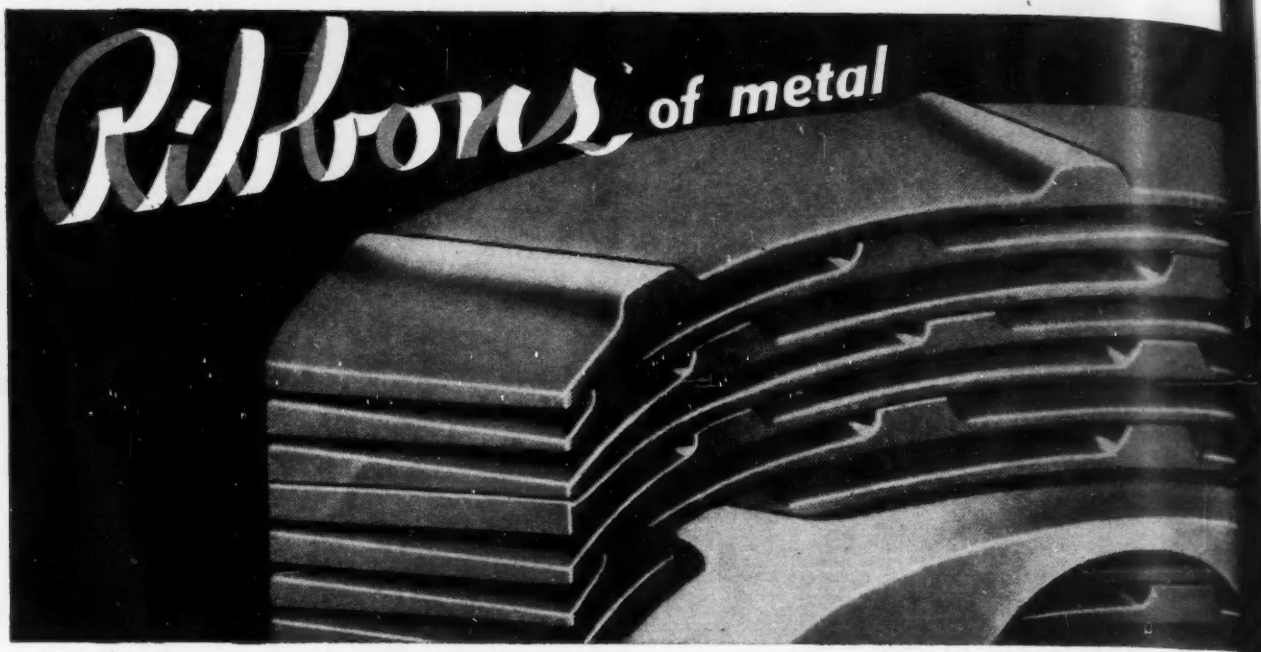
Assured Uniformity, both in complete units, and replacement parts which are readily available at important industrial centers.

Low Cost is controlled by precision standards developed through over a quarter of a century of specialized clutch manufacture and modern mass production methods.

To accompany this strong quartet of advantages the Twin Disc Clutch Company offers the services of a group of field and factory engineers to aid you in selecting the correct friction clutch or hydraulic drive for your particular application. Complete Engineering bulletins await your request. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Ill.).



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918



..to entrap particles or to separate liquids!

Not woven wire cloth...not fabric... but *ribbons of metal*...do the filtering in an element developed by Purolator.

The principle is entirely new. The enlarged section (above) shows its construction.

A metallic ribbon is wound edgewise on a cylindrical perforated frame. At regular intervals, supporting projections occur. Their height determines the degree of filtration. Elements can be made with filtering gaps as small as 0.0005"; as large as 0.025".

In operation, the filtrate passes between the ribbons, leaving its solids on the outer edges. Clogging of the passages is prevented by the ever-decreasing cross-section of each ribbon.

Once Purolator had worked out the design, there still remained the big problem of finding a metal that would make the design practicable.

Such a metal had to be ductile and workable—to permit forming of the intricately-shaped ribbons.

It had to resist corrosion—for the slightest corrosion would destroy the precision spacing of the gaps.

It had to be hard—so that edges of the thin ribbons would neither burr nor wear under the abrasion of a doctor blade with which some models are equipped to remove accumulated sludge.

By using Monel, all three demands—*and more*—were met!

Monel is corrosion-resistant . . . hard . . . workable. The ridged, tapered ribbons can be formed with no intermediate annealing. (*The next best material had to be annealed three times before reaching the final shape.*)

Thus, once again, Monel made a difficult job possible. Investigate Monel and all the INCO Nickel Alloys whenever *you* plan trouble-free operation in the equipment you design or buy. The International Nickel Company, Inc., 67 Wall St., New York 5, N. Y.

MONEL ELEMENTS INSURE EFFICIENT FILTRATION

These new Purolator elements made of Monel are used for filtering hydraulic fluids, gasoline and lubricating oils.

Shown at left above is a filter designed primarily for hydraulic systems actuated by emergency hand pumps. This unit operates either in the pressure or suction line. Filter gaps in the Monel elements are spaced at .003".

The smaller filter at the right, also intended for use in a hydraulic system, has a filter gap of .003" to protect a .021" orifice against clogging.

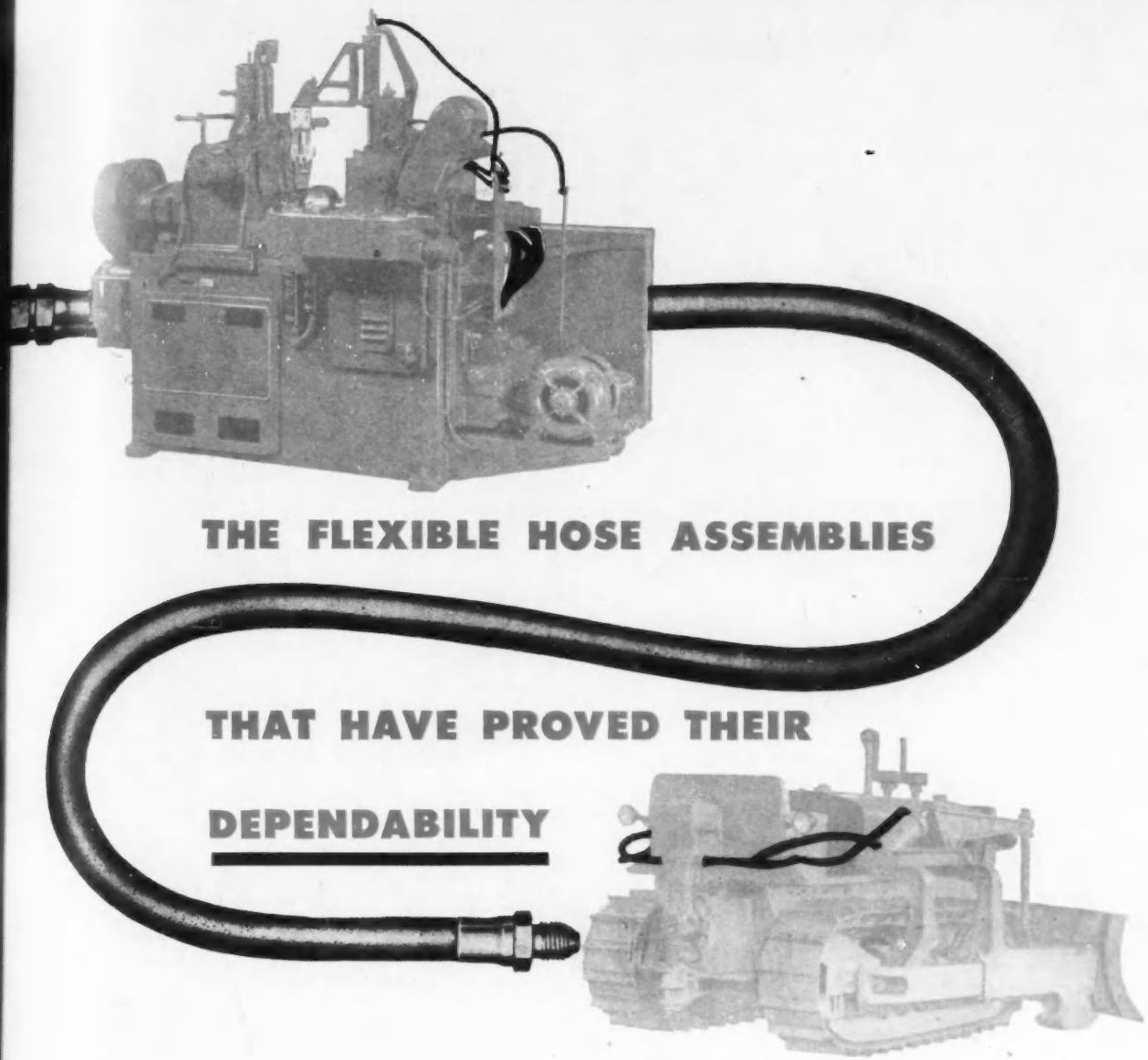
For detailed information on metallic ribbon filtering elements adapted to other types of hydraulic controls, or to gasoline or oil lines, write Purolator Products, Inc., 744 Broad Street, Newark, N. J.

NICKEL INCO TRADE MARK ALLOYS

MONEL* • "K" MONEL* • "S" MONEL* • "R" MONEL* • "KR" MONEL* • INCONEL* • "Z" NICKEL* • NICKEL

Sheet...Strip...Rod...Tubing...Wire...Castings...Welding Rods (Gas and Electric)

*Reg. U. S. Pat. Off.



THE FLEXIBLE HOSE ASSEMBLIES

THAT HAVE PROVED THEIR

DEPENDABILITY

FLEX-O-TUBE HOSE ASSEMBLIES, because of their proved durability and dependability, were used to equip thousands of combat planes throughout the war. They had an excellent service record.

Isn't it reasonable to expect hose assemblies of this character to do as good a job when used by industry as connections on

- ★ HYDRAULIC LINES FOR MACHINE TOOLS
- ★ HEAVY MACHINERY AND VEHICLES
- ★ HIGH PRESSURE LUBRICANT LINES ANYWHERE
- ★ COMPRESSED AIR LINES
- ★ WATER LINES

Special equipment originated by Flex-O-Tube is used to anchor the terminal fittings.

Ask Flex-O-Tube engineers for their recommendations on your needs.

Flex-O-Tube COMPANY

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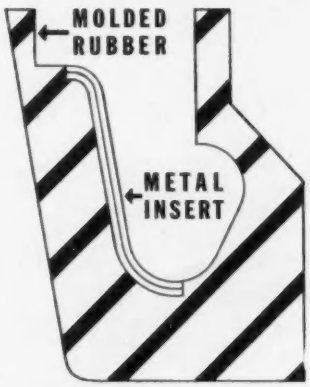
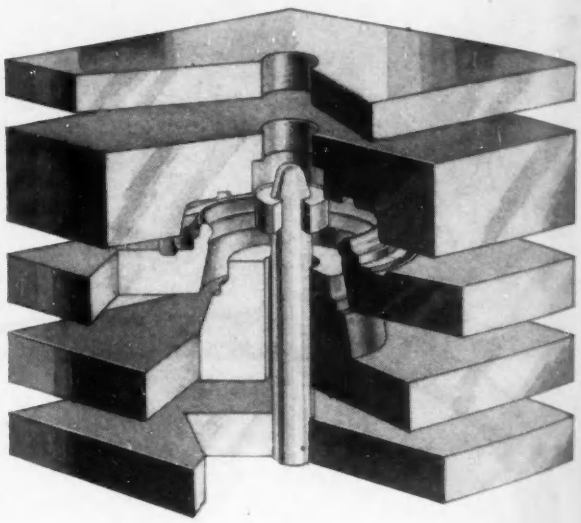


"SIMPLE" PARTS often demand COMPLEX MOLDS

The relatively "simple" rubber-to-metal part indicated by the cross-sectional drawing above requires the complex, multiple-cavity mold illustrated at the right.



The "simple" rubber-to-metal part is not necessarily free of complications in producing it. As the above example illustrates, an intricate, multiple-cavity mold is required to produce the part that looks so "simple."

First consideration is the combination of conditions under which the finished part is to function. Next comes the design and manufacture of the mold to produce it. Then the correct compound of rubber or rubber-like material must be determined to meet both the molding and functional requirements. Exceptional precautions must be taken to prevent heat expansion from causing variations in the mold cavities, and often the mold cavities have to be registered individually with each other. Those and other related problems must be brought into "harmony" by modern techniques of the rubber industry. Briefly, it is a combination of "know-how" factors available here at "ORCO" that is causing an unprecedented demand for our services from a wide diversity of industries.

ORCO-OPERATION is a one word designation of complete cooperation in engineering and manufacturing mechanical molded and extruded rubber parts including rubber-to-metal adhesion parts . . . all available at The Ohio Rubber Company.

"ORCO-OPERATION"

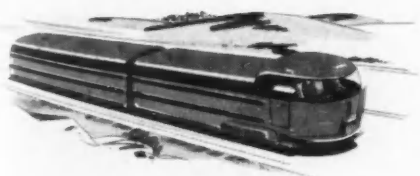
THE OHIO RUBBER COMPANY · WILLOUGHBY, OHIO

BRANCHES: DETROIT • NEW YORK • CHICAGO
INDIANAPOLIS • WASHINGTON • CLEVELAND

How Timken Service has helped operators of over 500,000 VEHICLES

● In thousands of on-the-job contacts, and in 1704 group meetings, Timken Axle Regional Representatives have performed a vital service for operators of more than 500,000 vehicles. They have demonstrated the benefits of proper maintenance, encouraged more intelligent vehicle selection and use, and given timely tips on how to keep 'em rolling.

This part of Timken Axle's established overall program insures better performance and cuts maintenance cost. It is a service freely given by us to operators, vehicle manufacturers, factory branches and dealers.



You can benefit, too

When buying new vehicles: (1) Analyze the job each vehicle must do; (2) Study specifications and buy your vehicle to fit your job; (3) Protect your investment by good maintenance and careful operation. If you do these three things, you're bound to benefit in overall operating efficiency.

Manufacturers will be ready soon with new vehicles. Timken will be ready, too, with the finest line of axles incorporating the greatest advances in the history of the axle industry.

Ask about axles when you buy. Be sure you get Timken Axles.

TIMKEN AXLES

TIMKEN AXLES

THE TIMKEN-DETROIT AXLE COMPANY, DETROIT 32, MICH.
WISCONSIN AXLE DIVISION • OSHKOSH, WISCONSIN

Bring on your cars of the future!

There have been times when automotive engineers had to pull their creative punches—because motor fuels weren't up to their advanced designs.

Catalytic cracking, developed and commercially pioneered by Houdry, has changed all that.

59 Houdry and TCC catalytic cracking units are ready to meet whatever requirements for motor fuel quality may be called for by your most imaginative post-war designs.

★

HOUDRY PROCESS CORPORATION

WILMINGTON, DELAWARE

New York Office: 115 Broadway

Houdry Catalytic Processes and the TCC Process are available through the following authorized firms:

E. B. BADGER & SONS CO.
Boston, Massachusetts

•

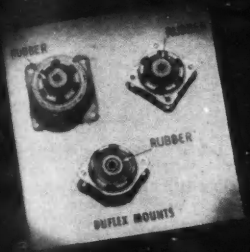
THE LUMMUS COMPANY
New York City, New York

•

BECHTEL-McCONE CORP.
Los Angeles, Calif.

HOUDRY CATALYTIC PROCESSES
... FOR VICTORY IN WAR
... FOR PROGRESS IN PEACE

Torflex Flexible BEARINGS HARNESS VIBRATION AND NOISE

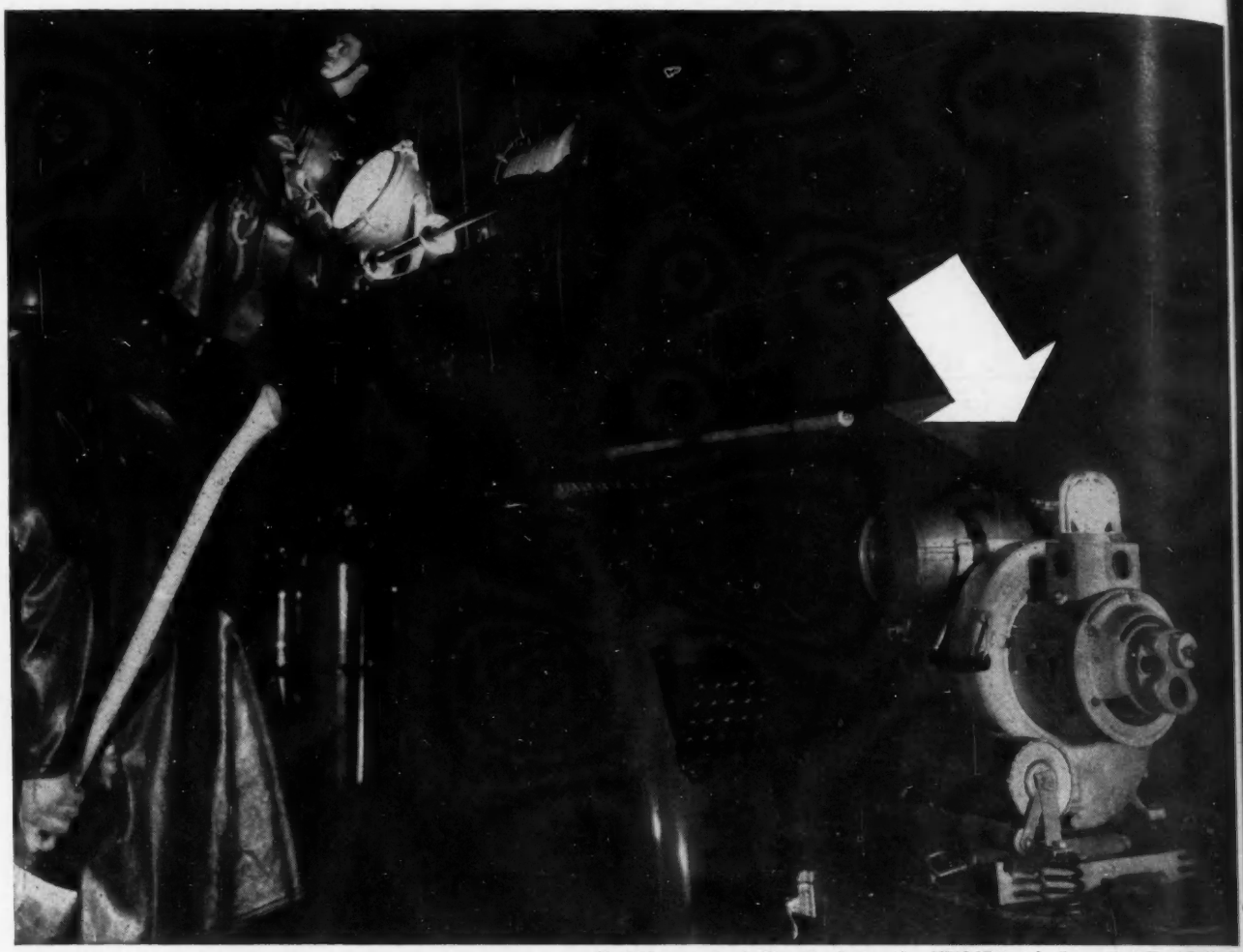


● Three of the most destructive enemies moving parts have to contend with are vibration, noise and shock. They impair smooth operation, cut down efficiency, produce excess wear and shorten the life of any piece of equipment. Torflex Flexible Bearings were created, engineered and designed to control and eliminate vibration, noise and shock and are manufactured by Harris Products Company, pioneers in the field of engineered vibration control.

Torflex Flexible Bearings consist of a tube or ring of rubber stretched longitudinally between two concentric metal sleeves which prevent the rubber from returning to its original state. The pressure thus exerted by the rubber, on the metal sleeve, insures a high capacity mechanical bond between the rubber and metal under all operating conditions. Torflex Flexible Bearings are free from wear, also have long life, compensate for parallel and angular shaft misalignment, require no lubrication, and are widely used to transmit torque. They come in a wide range of sizes, are simple and easy to incorporate in designs and to install.

We welcome the opportunity to discuss with engineers and manufacturers the possibilities and the many advantages of Torflex Flexible Bearings in the control and elimination of vibration, noise and shock. Drop us a line today.

HARRIS
PRODUCTS COMPANY
CLEVELAND 4, OHIO



Portable generator by Homelite Corporation. HYCAR part by Connecticut Hard Rubber Co.

HYCAR helps shed light on a burning problem

IN many modern fire departments, portable gasoline driven motor-generator sets, like the one in the picture, power the floodlights that help firemen fight night fires. The heart of the engine that drives the generator is a highly sensitive needle valve; and the heart of the needle valve is a tiny resilient HYCAR seal upon which the *entire* performance of the unit depends. If the seal fails — the engine stops, lights go out, property and lives are further endangered.

HYCAR was selected for this service because it had the right properties in the right combination to meet a wide variety of service conditions. The seal spends its life soaked in a gasoline and oil mixture, yet it must not change shape or deteriorate in any kind of fuel. It must stay resilient over an extremely wide temperature range. There must be no sticking to the metal valve shaft.

HYCAR has all these properties as well as those shown in the list at the right. They suggest a wide variety of *new* uses in *all* industry. So ask your supplier for parts made from HYCAR for test in your own applications—severe or routine, new or old. You'll find that HYCAR is the material to use for long time, dependable operation. *Hycar Chemical Company, Akron 8, Ohio.*

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. **EXTREME OIL RESISTANCE** — *insuring dimensional stability of parts.*
2. **HIGH TEMPERATURE RESISTANCE**—*up to 250° F. dry heat; up to 300° F. hot oil.*
3. **ABRASION RESISTANCE**—*50% greater than natural rubber.*
4. **MINIMUM COLD FLOW** — *even at elevated temperatures.*
5. **LOW TEMPERATURE FLEXIBILITY** — *down to —65° F.*
6. **LIGHT WEIGHT** — *15% to 25% lighter than many other synthetic rubbers.*
7. **AGE RESISTANCE**—*exceptionally resistant to checking or cracking from oxidation.*
8. **HARDNESS RANGE**—*compounds can be varied from extremely soft to bone hard.*
9. **NON-ADHERENT TO METAL**—*compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers

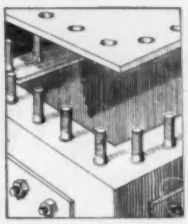
6 ways to fasten metal parts in ½ second with NELSON *automatic* STUD WELDING

The NELSON Stud Welder is fully portable, works from any standard welding generator, and welds in any position. Studs from ⅛" to ¾" in diameter and up to 8" in length are welded with complete fusion to metal in ½ second.
To speed production, to do a *better* job faster, put this versatile tool on *your* job. The facts are yours for the asking . . .

☞ *WRITE NOW for complete information, or to arrange a demonstration in your own shop at your convenience . . .*

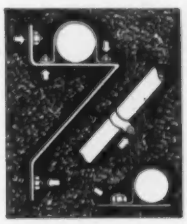
NELSON SALES CORPORATION
LORAIN, OHIO
Representatives and Distributors for
Nelson Specialty Welding Equipment Corp., San Leandro, California
Nelson Stud Welding Corp., Lorain, Ohio

STRAIGHT STUDS



Securing Covers: Covers of all kinds, with or without gaskets, can be secured quickly and easily. Usually the cover itself can be used as a template; studs are welded through the cover holes.

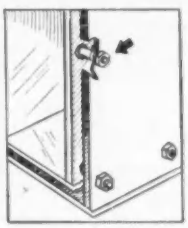
Pipe Hangers and Brackets: There are scores of faster, better ways to secure pipe, tubing or conduit with stud welding. Welds can be made in all positions; welder is completely portable.

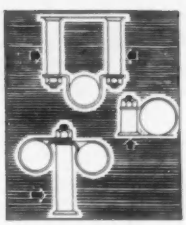


General Fastening to Metal: Wherever brackets or attachments must be secured to sheet, plate or structural metal, the stud welder can do the job at the rate of one-half second or less per weed.

SHOULDER STUDS

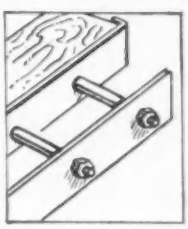
Metal Liners and Jackets: The shoulder stud provides correct spacing between liner and casing or jacket, and no holes pass through the liner which can be left smooth and unblemished.





Securing Pipe, Cable and Hose: Shoulder studs provide a fast, convenient method of attaching many types of pipe, conduit, cable, tubing or hose; three typical applications are illustrated at left.

Spacer and Bumper Bars: Spacer bars, bumpers and guard rails can be attached simply and economically with shoulder studs. Portability of the stud welder makes the job easy on large assemblies.

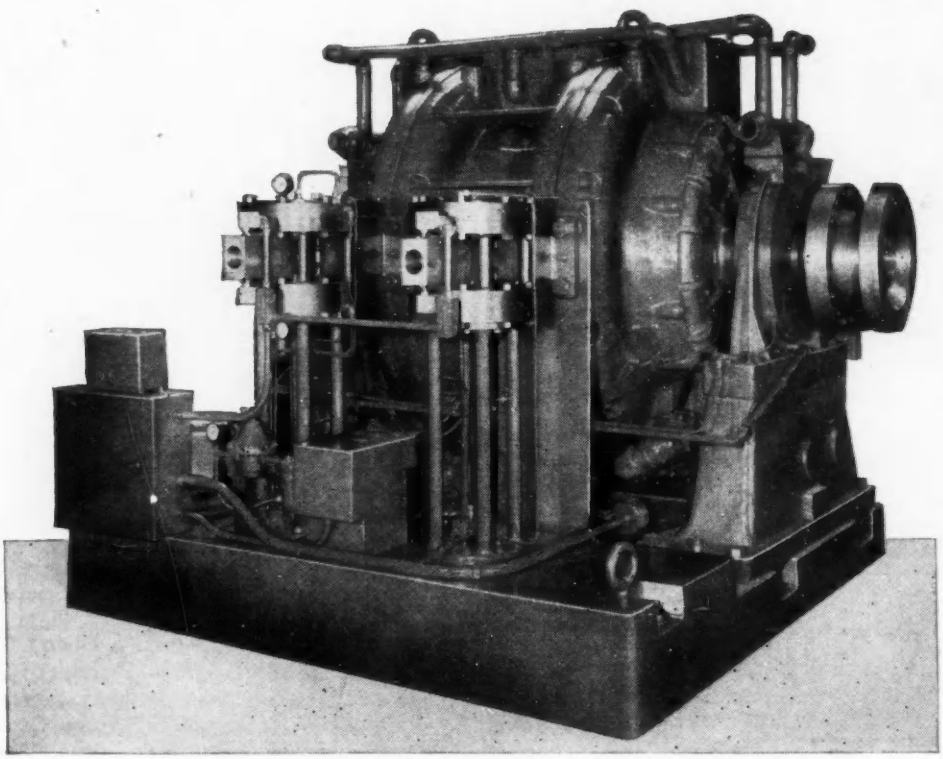


OTHER NELSON FLUX-FILLED STUDS

HAGAN

The Hagan ThrusTorq

And Its Application
To Engine Testing



Installation of Two Hagan Double ThrusTorq
Units with Electric Dynamometer

BULLETIN 9345

HAGAN CORPORATION • HAGAN BUILDING • PITTSBURGH, PA.

This bulletin

TELLS WHAT YOU WANT TO KNOW

ABOUT MEASURING TORQUE AND THRUST

with air

Hagan THRUSTORQ measures torque and thrust *with air*. There are no knife edges, no mechanical balancing, no moving parts except for the almost imperceptible motion of a diaphragm and a poppet valve.

With this method of measurement, torque at all speeds and loads can be measured without adjustments or compensations of any kind. Where unusually large engines require the use of several dynamometers, Hagan THRUSTORQS may be connected so that the reading is automatically totalized.

Continuous test records may be obtained by the use of standard pressure recording devices.

This booklet gives full information on Hagan THRUSTORQ—what it is, how it works, data on range and accuracy, types available—practically everything you need to know to decide how THRUSTORQ can be used in your plant. There's no obligation—just mail the coupon below.

HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH 30, PA.

AN THRUSTORQ
measuring thrust and torque *with air!*

HAGAN CORPORATION
HAGAN BUILDING
PITTSBURGH 30, PA.

Please send me your Bulletin 9345 "The Hagan THRUSTORQ and Its Application to Engine Testing."

Name

Position

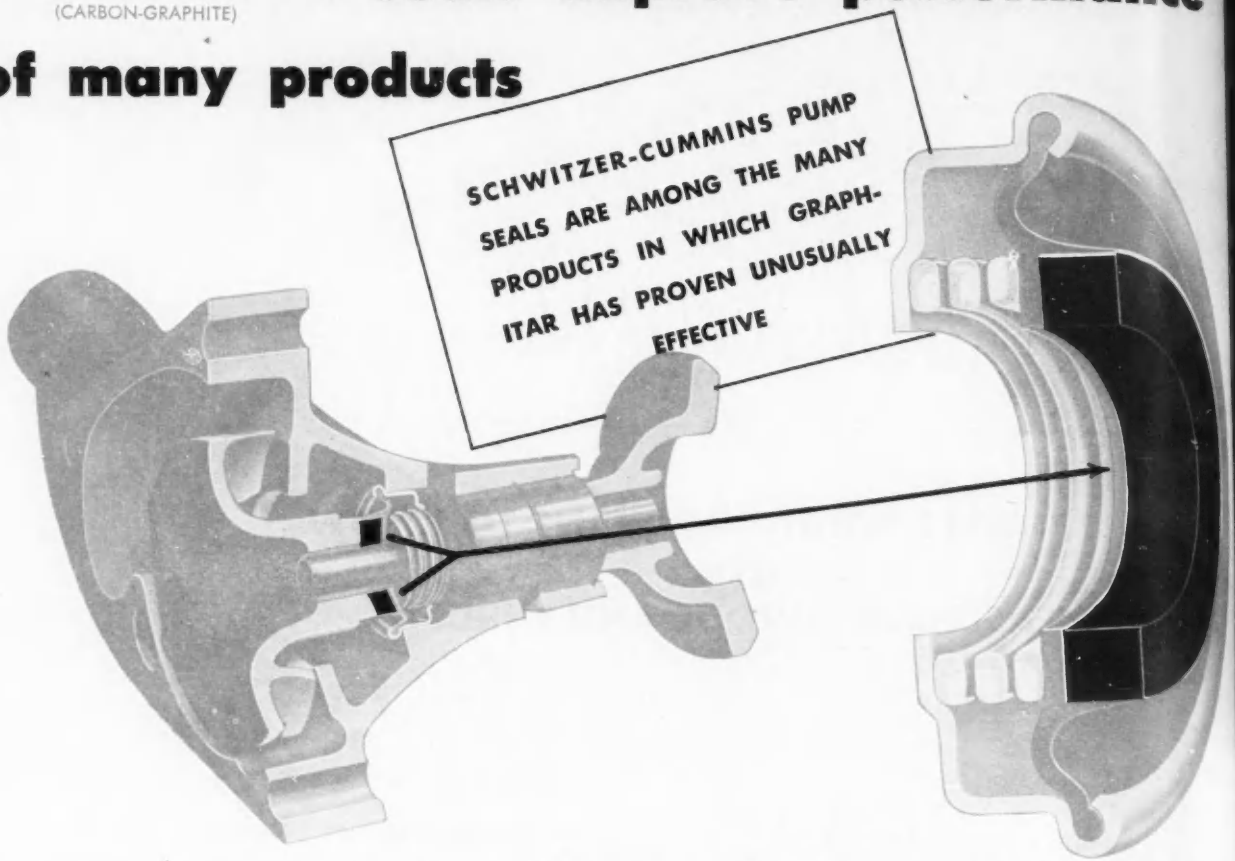
Company

Street and Number

Post Office *Zone No.* *State*

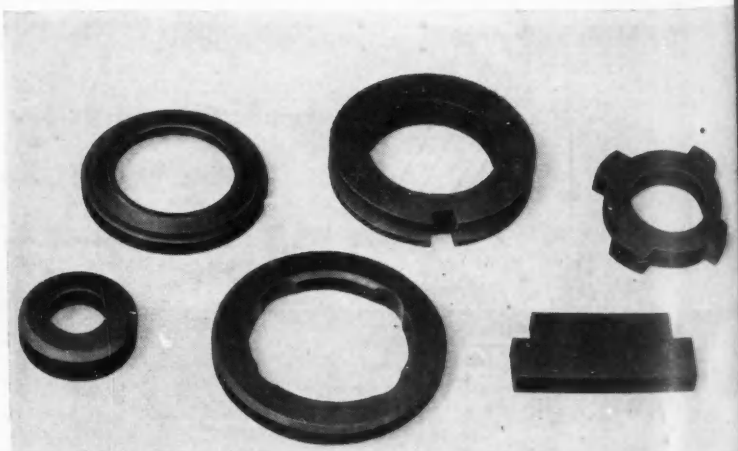
GRAPHITAR seals improve performance of many products

(CARBON-GRAPHITE)

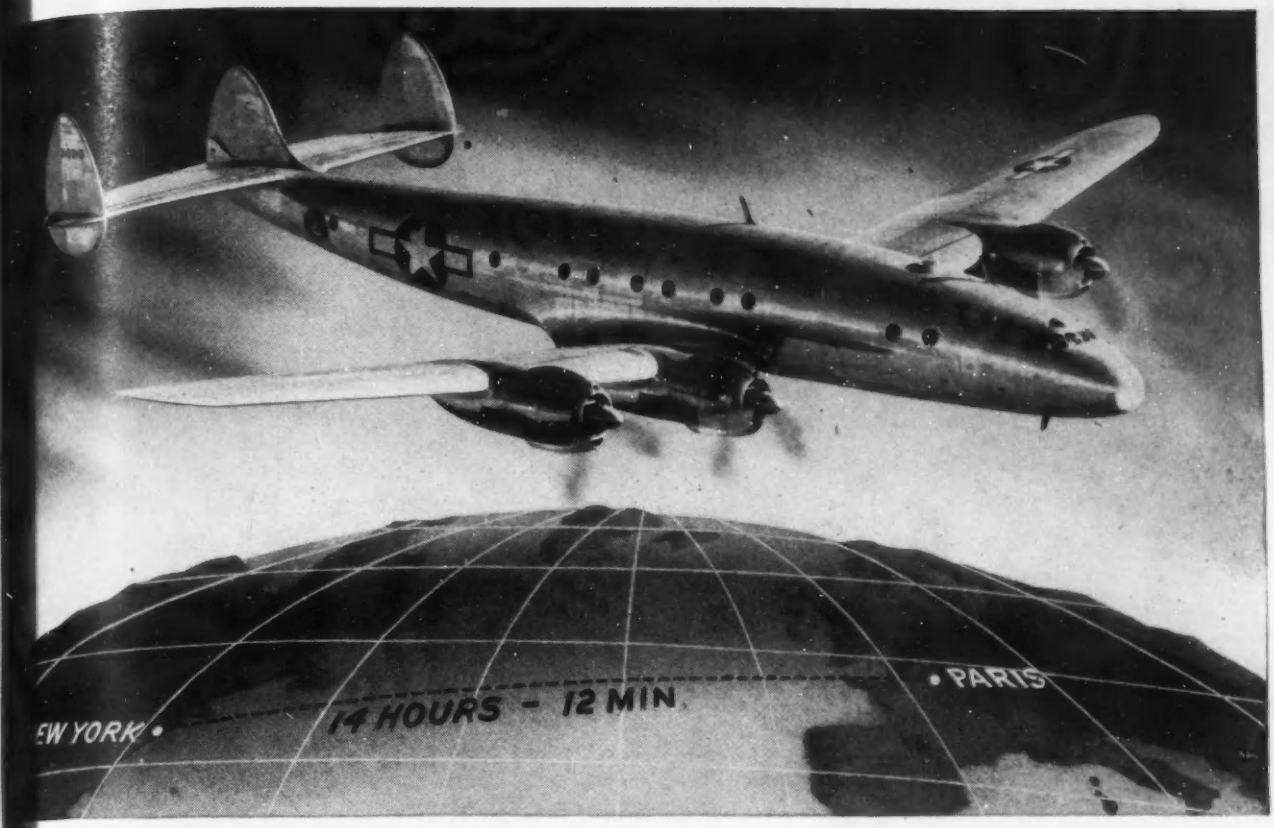


The unique characteristics of Graphitar, the unusual carbon-graphite material, make it effective for seals in a wide variety of liquid pumps. For example, Graphitar seals are standard in the latest type automotive pump seals being produced by the Schwitzer-Cummins Co. for installation in many new automobile models now rolling off production lines. Water, alcohol, or other anti-freeze cannot leak through a Schwitzer-Cummins seal, and because of the wear resistance of Graphitar the seal will usually last for the life of the car. In many other automotive applications, Graphitar seals are proving equally efficient. In fluid couplings, torque converters, and hydraulic transmissions they retain hot oil even under 60 lb./sq. in. pressures at 350° F. and 500 ft./min. speed. Graphitar seals and blades hold air under extreme pressure in automotive brake systems.

Graphitar has a versatility which has won widespread acceptance throughout industry. Because it will not melt or fuse at any temperature, Graphitar makes exceptionally serviceable diabolos, molds, and carrying pads for glass-making operations. It is chemically inert—resists hydrochloric acid, sodium hypochlorite acid and other corrosive solutions. Graphitar is extremely resistant to wear, hence makes ideal bearings and piston rings. Light-weight, yet mechanically strong, Graphitar can be machined to almost any shape and can be ground to tolerances as close as .0005" in small sizes. For complete information on how Graphitar may solve some problem confronting you, WRITE TODAY FOR NEW 44-PAGE ILLUSTRATED CATALOG.



THE UNITED STATES GRAPHITE COMPANY • SAGINAW, MICHIGAN



OCEAN-SHRINKER
-- 45 Tons of Speed

May 20, 1927, a young unknown named Charles A. Lindbergh mbed into a tiny monoplane at New York and 33 hours and 30 nutes later landed at Paris, France. Immediately he became a rld-wide hero.

But on August 1, 1945, the ATC's C-69 Lockheed "Constellation" de a casual 3,600 mile N. Y. — Paris flight in 14 hours and 12 nutes breaking all trans-Atlantic transport records. Yet this rdly rated a mention in the newspapers.

The progress of aviation is so swift that new records are made nost daily as new designs and greater power plants step up speed l efficiency. Helping the C-69 to this newest record were four at Wright engines developing 2,200 h.p. each . . . and each is ipped with CECO carburetors.

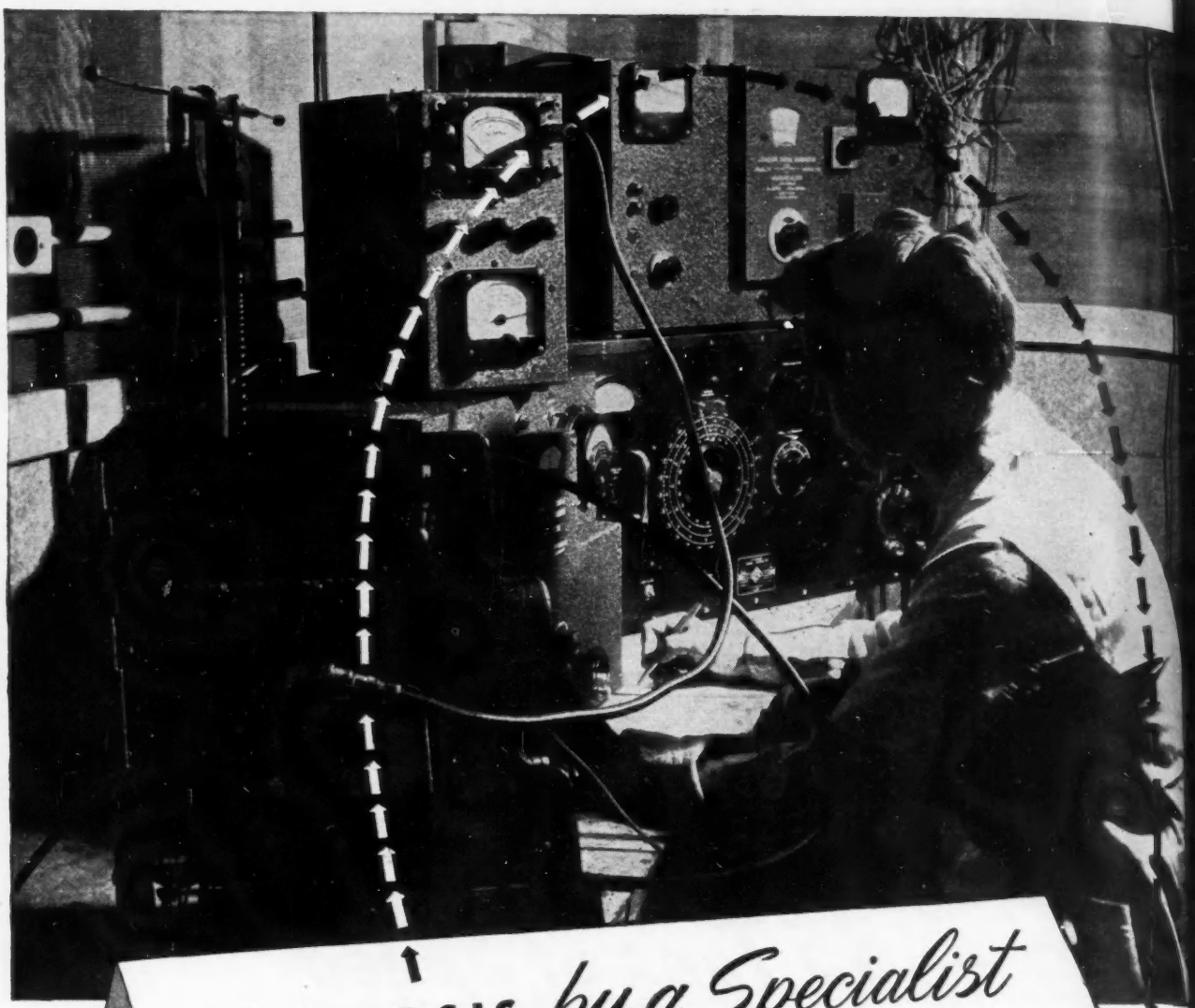
As new records are broken and greater aviation advances are de, Chandler-Evans will continue to use all its war-proved en- eering and production resources to keep pace with America's craft engine builders.

CECO

CARBURETORS
FUEL PUMPS
PROTEK-PLUGS

CHANDLER-EVANS CORPORATION

SOUTH MERIDEN
CONNECTICUT, U. S. A.



DIAGNOSIS *by a Specialist*

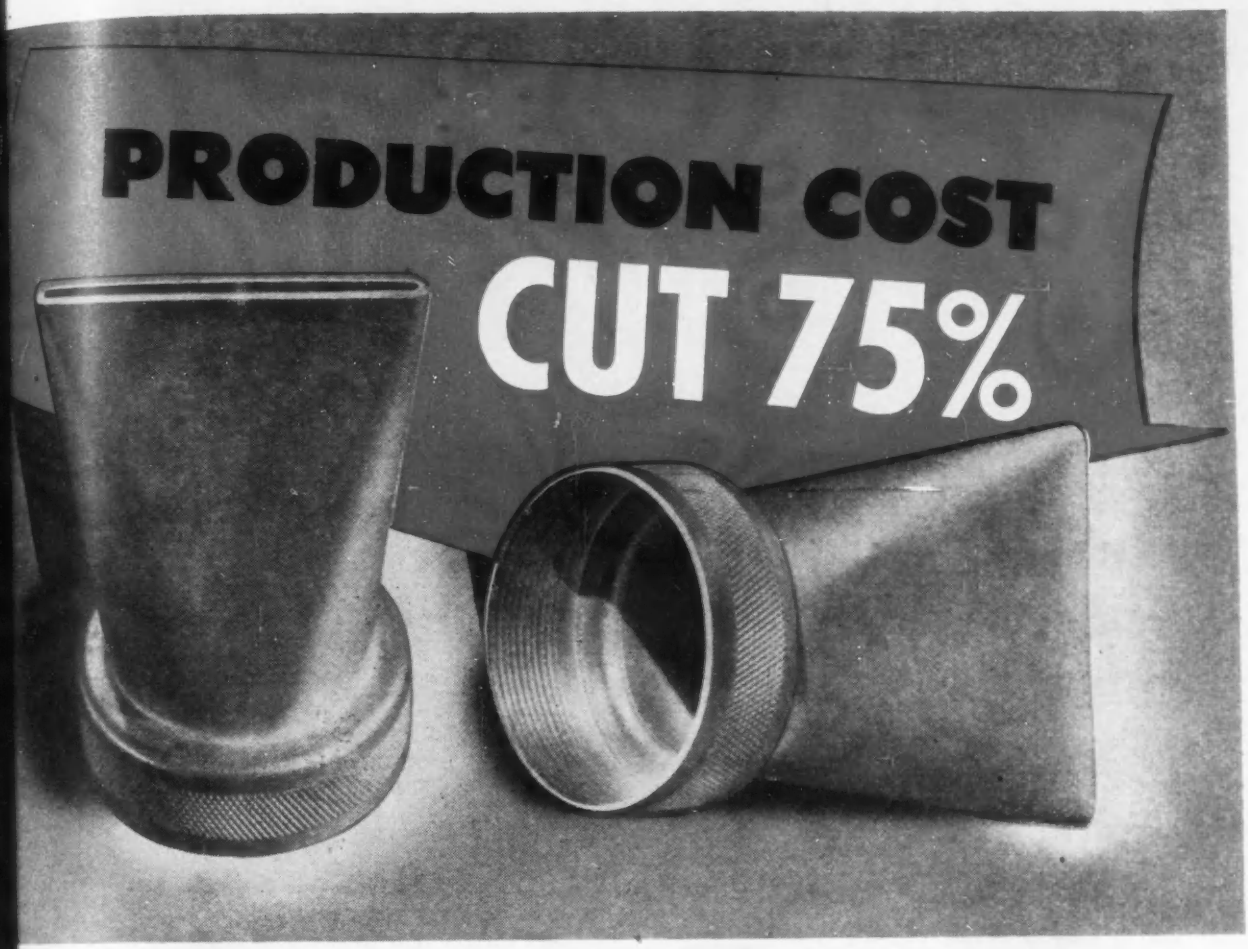
THE CURE OF RADIO NOISE is a highly specialized task that involves much more than simply "hooking a condenser across the line". It requires exact knowledge of the proper size and type of capacitor to use . . . of the correct place to add it to the noise-making circuit . . . of the necessary length or positioning of connecting leads . . . and of many other seemingly trivial, but actually vital, bits of information that cannot rightfully be expected of the electrical design engineer.

This exact knowledge is available to you when you must provide radio silence for electrical apparatus. Just send us the offending equipment and we will measure its radio noise output according to standard specifications, will design the most efficient Filterette to cure the noise, will specify the proper means of installing it, and, upon your adoption of our recommendations, will authorize your use of the FILTERIZED label that tells buyers your apparatus will not interfere with radio reception. This service is free to users of Tobe Filterettes . . . write for details.

SUPPRESS MAN-MADE RADIO STATIC
TOBE
FILTERIZED

TOBE DEUTSCHMANN CORPORATION-CANTON, MASSACHUSETTS

ORIGINATORS OF FILTERETTES . . . THE ACCEPTED CURE FOR RADIO NOISE



with *Republic* ELECTRUNITE *Tubing*

merly, the caulking gun nozzle shown above was duced by flattening one end of a short piece of tubing brazing the opposite end to a threaded collar.

, with Republic ELECTRUNITE Tubing, brazing been eliminated. The complete nozzle is formed from length of 1¾″ O.D. x 16 gauge tubing in two press rations. These consist of forming the knurled shoulder by expanding the tubing from 1¾″ O.D. to 2¼″ O.D. flattening the nozzle end over a die. The knurled lder is then threaded and the part is ready for plating.

savings resulting from the change in production hods are estimated at 75% by the manufacturer.

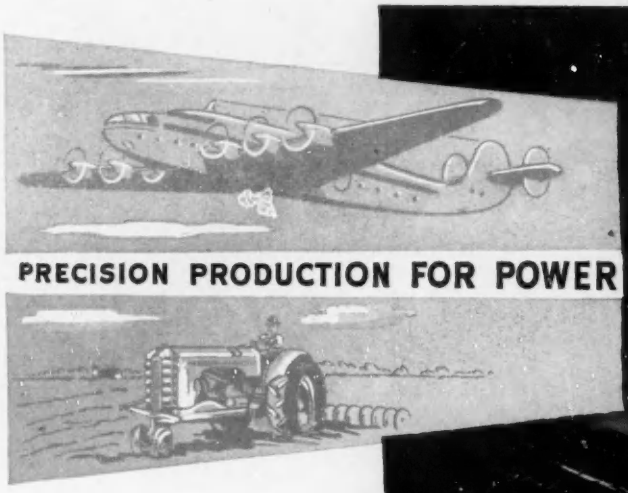
Perhaps you, too, have an application in which the use of highly ductile and easy-to-fabricate ELECTRUNITE Tubing can cut production cost or improve product quality. Remember that this *modern* tubing's consistent uniformity in diameter, wall thickness, concentricity and hardness assures perfectly-formed finished tubular parts—with fine scale-free surfaces for the application of smooth coatings of plating, paint or plastic.

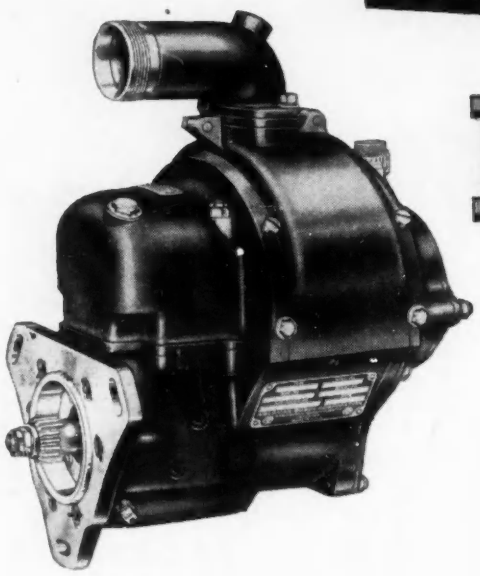
ELECTRUNITE engineers are always ready to help you get the most out of tubing. For more information write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
TUBING

hanical, Aircraft, Stainless Steel and Rail Steel Tubing—Boiler, Condenser and Heat Exchanger Tubes





American Bosch Magnetos have served with distinction on many of our greatest warplanes and in more than 25 other military applications. *They are available today for agriculture, construction and other domestic uses.*

Portrait of a Spark

It is important to *know* that each individual spark in the po stream that flows from an American Bosch Magneto is the ri *kind* of spark for top engine performance.

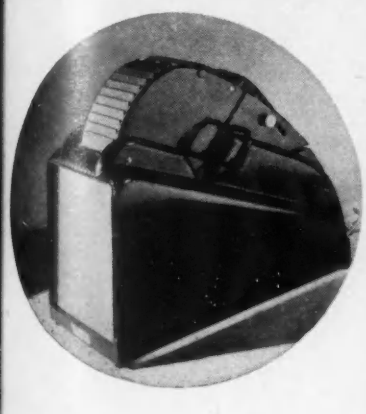
Here, an American Bosch technician uses a cathode-ray osci graph to "paint the magneto's performance portrait." From screen he is able to determine its characteristics of current, volt and spark length and to forecast its performance in actual use

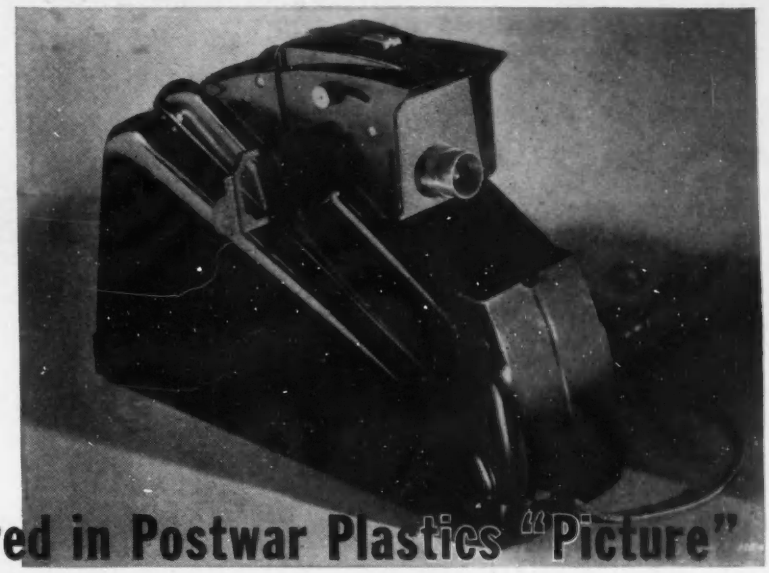
Making sure is inherent in Precision Production for Power. combination of traditional craftsmanship and specialized gineering knowledge attends every production step. The result reliability of American Bosch products is further backed up by world-wide maintenance organization.

AMERICAN BOSCH CORPORATION
Springfield 7, Massachusetts

AMERICAN BOSCH

AUTOMOTIVE AND AVIATION ELECTRICAL PRODUCTS • FUEL INJECTION EQUIPME





Phenolics featured in Postwar Plastics "Picture"

phenolics are the most versatile of all ics. Naturally, this makes their use ically universal throughout industry. he electrical manufacturing field, for ple, you will find phenolic molding ounds being used for literally thousands thousands of vital parts. The Novex bination Projector Viewer shown above s as an excellent illustration of this t. Its sturdy heat-resistant plastic ng was molded from a Durez phenolic ound

s Novex Combination Projector wer effectively demonstrates the ctical, sales-stimulating use to ch Durez phenolic molding com- nds can be put. Its durable, eye- ealing 14"-long body is molded in piece. The complete unit embodies eral molded Durez parts. With ded-in inserts, these, naturally, p to make assembly a simple cess and keep production costs a minimum.

Heat-Resistant Housing

By molding the housing for this Combination Projector Viewer of Durez, the manufacturers gain the heat-resisting and heat-insulating characteristics so necessary for the efficient operation of a machine of this type. Furthermore, a rugged yet lightweight construction results.

Properties of the Phenolics

Just as the Novex Corporation found a Durez phenolic plastic that fitted their job, so have many other manufacturers. Such desirable properties as heat and moisture resistance and dielectric strength make Durez compounds of unusual value to electrical manufacturers Additional inherent characteristics such as highest dimensional stability at temperature extremes, excellent moldability, and impact strength make them extremely useful to the automotive industry. Closure manufacturers find the eye-appealing, non-bleeding finish of molded Durez to be the answer to their materials problems. Time and again the versatility of the more than 300 Durez phenolic molding compounds has provided the solution to the materials problems of the imaginative design engineer.

Competent Assistance Available

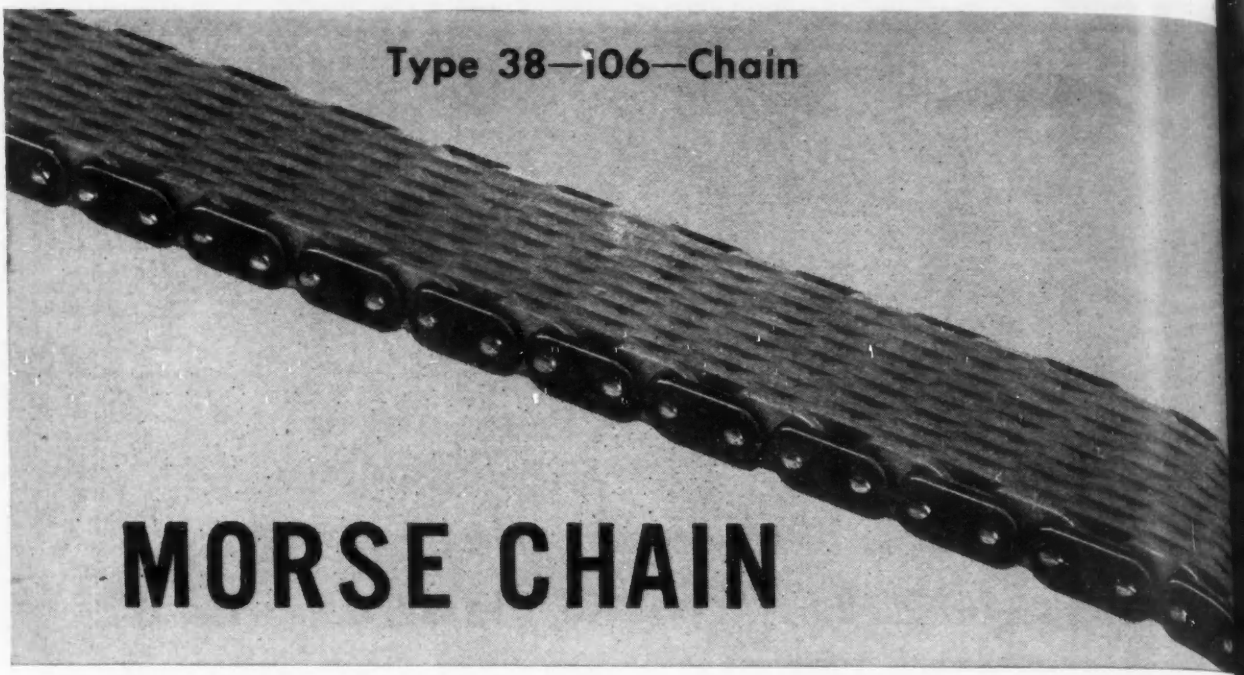
The Durez laboratory technician is an experienced man. Years of successful development work and the continuing leadership of Durez phenolic plastics attest this. Your custom molder is also an experienced man. Many new molding methods and processes make his service even more valuable than before. Put these two men together and you'll stand an excellent chance of coming up with the answer to any practical plastic materials problem which you may have. The services of the Durez staff are available at all times to you and your custom molder. Durez Plastics & Chemicals, Inc., 5012 Walck Road, North Tonawanda, N. Y.
Export Agents: Omni Products Corporation, 40 East 34th Street, New York 16, N. Y.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

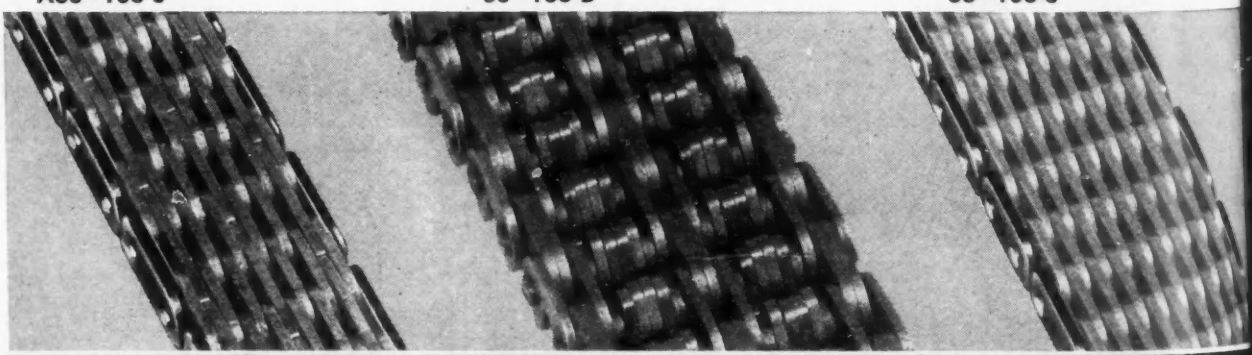


Streamlined Design . . . Streamlined Performance!

Precision-built, quiet and smooth in operation, this new ⅜" pitch automotive timing chain is manufactured to the latest and most modern precision standards. It is a product of war experience in die practice and metallurgical development. A round pin, ground to a mirror finish, and a specially formed semi-circular bushing are securely seated in their respective link sections.

This new, improved chain offers definite advantages in either short-center, two-sprocket drives, and drives requiring take-up idlers or double-step ratios, where long centers are involved.

Assembly A38—106-S **Assembly 38—106-D** **Assembly 38—106-S**



SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *Roller and Silent* CHAINS

MORSE CHAIN COMPANY • ITHACA, N.Y. • DETROIT 8, MICH. • A BORG-WARNER INDUSTRY

STRAIGHT-LINE FORCE!

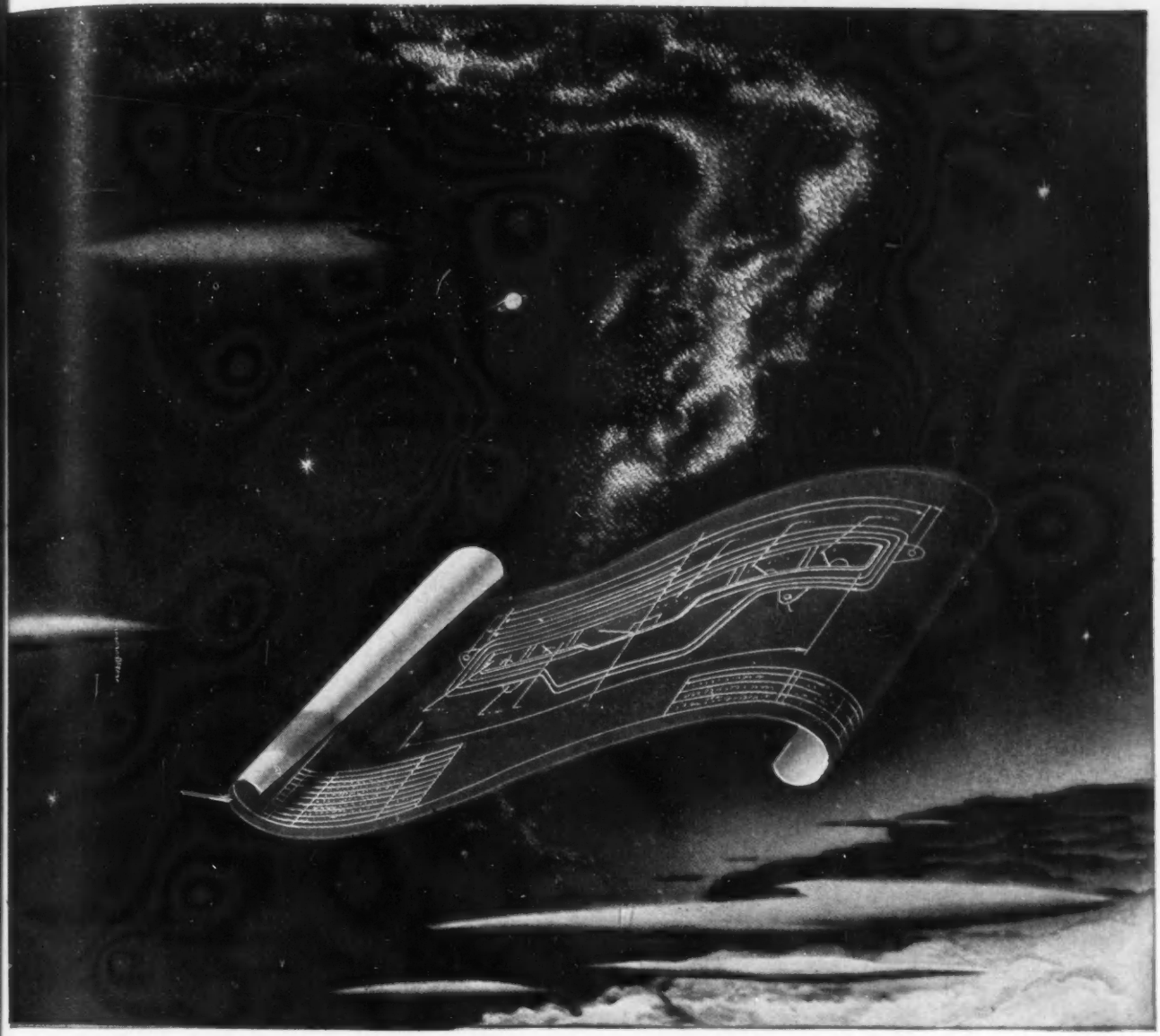
Whenever a cylinder is required for actuation of machine elements, investigate the ELECTROL line. Engineered for battle service, these cylinders are designed to meet pressure requirements. They are lightweight, low-cost, positive in operation and simple in construction. The wide range of sizes available is listed in the accompanying table.

ELECTROL cylinders, like other ELECTROL units are precision-designed and manufactured to close tolerances. Lightweight is achieved through use of high-strength alloys. Positive, service-free operation is attained through close control of every manufacturing process from honing to final assembly. Other ELECTROL products will fit into your peacetime design program: relief valves, check valves, follow-up valves, and selector valves. Investigate the possibilities today. Write *ELECTROL, Inc., Kingston, N.Y.*

ELECTROL'S HYDRAULIC CYLINDERS

ASSEMBLY NO.	BORE (Inches)	STROKE (Inches)	PORT SIZE (Inches)
143	5/8	5-1/2	3/8-24
354	7/8	7-3/4	1/2-20
351	1	21-15/16	1/2-20
348	1-1/16	16-1/2	1/2 P.T.
169-AN	1-1/8	4-3/4	7/16-20
166-AN	1-3/8	10	7/16-20
129-R-AN	1-1/2	1-1/4	7/16-20
335	1-5/8	3-13/32	7/16-20
329	1-3/4	5-3/32	7/16-20
364	2	1	1/8 P.T.
128-1-AN	2-1/8	9-5/32	9/16-18
102-AN	2-1/4	4-5/16	7/16-20
200	2-3/8	9-3/4	9/16-18
127-AN	2-1/2	7-1/8	9/16-18
296	2-3/4	15-3/4	9/16-18
188	3	9-1/32	9/16-20
107	4-1/2	10-3/4	9/16-20

ELECTROL
HYDRAULICS



We'd Like to Tell You About Our Dreams, Too!

Even while your '46 models are rolling off production lines—you're dreaming up the '47 versions. That kind of dreaming keeps the automobile industry years ahead *each year!*

Here at Stewart-Warner we dream, too. We experiment . . . improve . . . perfect.

From this far-sighted *practical* dreaming we've developed still newer principles of designing. These principles, applied to your new instrument panels, will contribute much to driving comfort—and add new beauty, too.

Every one of these principles is backed by our more than 40 years experience as instrument designers and suppliers to the automotive industry—plus new "know-how" we have acquired in working with you in war.

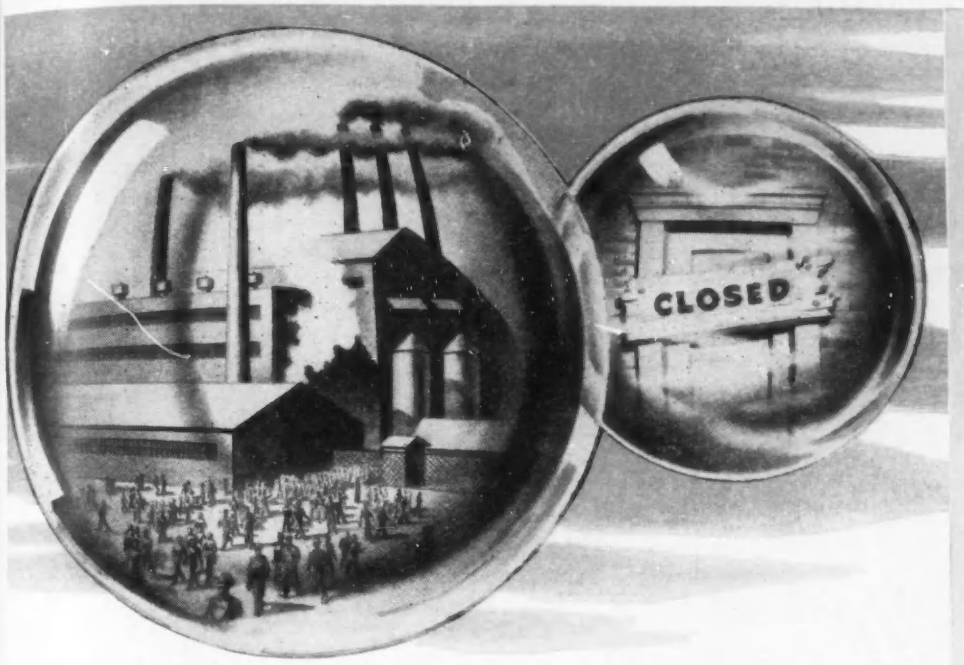
May we show you how this reservoir of experience and these new principles can be applied to your instrument problems *now?*

STEWART-WARNER CORPORATION

3-140 General Motors Building, Detroit 2, Michigan
1826 Diversey Parkway, Chicago 14, Illinois

STEWART WARNER

PRECISION INSTRUMENT SUPPLIERS TO THE AUTOMOTIVE INDUSTRY FOR 40 YEARS



WHAT'S AHEAD
FOR YOUR BUSINESS?

Don't gamble with the quality of your product . . . plan to use Ex-Cell-O precision production parts! With a complete organization under one responsible management . . . an organization built up of years of varied engineering experience, modern machine and manufacturing methods, and complete heat treat facilities, and practical assembling and inspection staffs . . . Ex-Cell-O probably has the exact solution to the parts production problem you face. Write today!

XLO
EX-CELL-O for PRECISION

EX-CELL-O's Precision Production Parts *facilities:*

PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

PRODUCTION MACHINES

Multiple Vertical Turret Lathes
Multiple Spindle Automatic Screw Machines
Single Spindle Automatic Screw Machines
Hand Screw Machines
Engine Lathes
Centerless O.D. Grinders
Centerless I.D. Grinders
Single and Multiple Spindle Drilling Equipment
Form Grinding Machines
Plain O.D. Grinders
Plain I.D. Grinders
Surface Grinders (Plain and Rotary)
Milling Machines
Thread Milling Machines
Broaching Machines (Vertical and Horizontal)
Precision Thread Grinders
Thread Rolling Machines
Precision Boring Machines
Lapping Machines
Special High Production Equipment

HEAT TREAT

Induction Heat Treating
Laboratory for Heat Treat Control Including Micro Examination and Photography
Atmosphere Control Continuous Hardening Furnaces
Atmosphere Control Box Hardening Furnaces
Various Types of Air-Draw Batch Type Furnaces
Gas Carburize Furnaces
Box Carburize Furnaces
Pack Anneal Furnaces
Nitriding Furnaces
Cyanide, Lead, and Neutral Salt Pot Furnaces
High Speed Steel Atmosphere Control
Vertical and Horizontal Hardening Furnaces
Continuous Air-Draw Furnaces
Sub-Zero Heat Treating Equipment

UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

INSPECTION

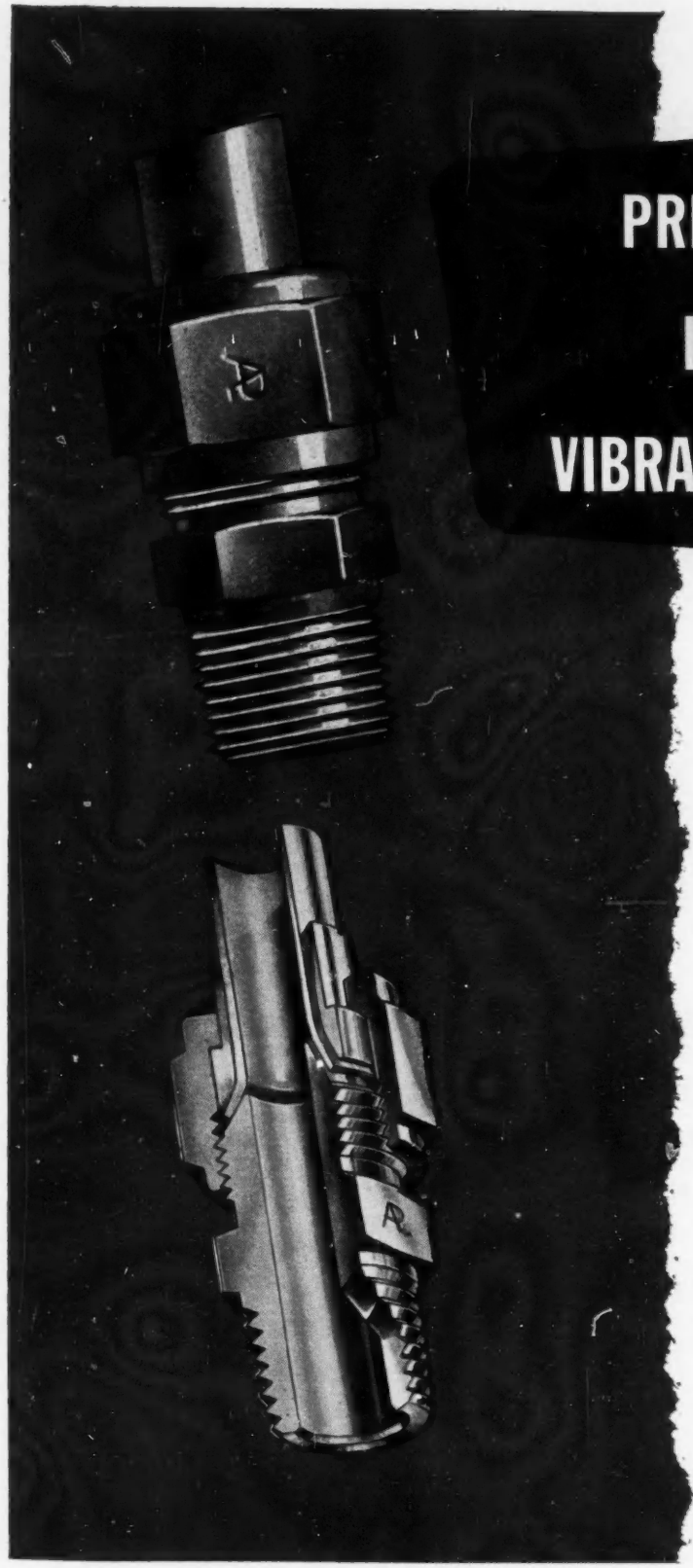
Ex-Cell-O has always maintained that quality in a product is not the result of accident; that quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by efficient inspection at every step of the machining process.

To right: Typical of the many modern and complete production machines in the Ex-Cell-O Miscellaneous Precision Parts Division—*facilities that are available for the production of accurate parts and sub-assemblies for your product*—is this sectional view of single automatic screw machines.

SEE EX-CELL-O FIRST

EX-CELL-O CORPORATION, DETROIT 6, MICH.

45—97



PRESSURE-TIGHT
LEAK-PROOF
VIBRATION-PROTECTED

The Parker Triple Type Fitting proved itself so efficient and economical that its principle was standardized for Army-Navy use on aircraft and ordnance.

The flared joint of this fitting provides maximum "tightness" without strain or tension on the tubing itself. It is fully protected against leakage under pressure, and is safe in conditions of extreme shock and vibration.

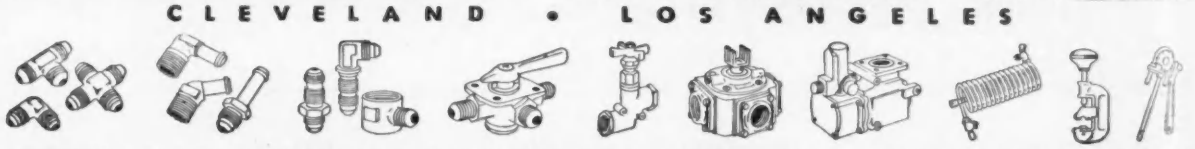
Parker systems provide streamlined flow, free from obstructions, and are easy to install and service, even in hard-to-get-at spots.

Production released by reduced military needs now permits you to use Parker fittings, in a wide variety of types, sizes and capacities, for power and fluid transmission systems.

Immediate deliveries from Parker warehouses, or from your mill supply house. Information gladly furnished by Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES



FLUID POWER PRODUCTS FOR ALL INDUSTRY

WHEELS THAT NEVER STOPPED

Throughout the war, America's vital cars and trucks and buses were kept rolling, as a necessary military measure.

Thus it was that institutions like AC actually improved their peacetime skills in wartime, by building the spark plugs, fuel pumps, oil filters and other units indispensable to these vehicles.

In all, AC built 459 *kinds* of war products for the Allies—machine guns, bombsights, aircraft spark plugs, Sperry automatic pilots, — a formidable list of specialized precision devices, for planes and ships and armies.

But through it all, the peacetime units flowed from AC production lines to service stations from coast to coast—keeping the wheels of vehicles rolling—developing the "know-how" gained through a third of a century—fitting AC to serve postwar motordom better than ever before.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

BUILDERS OF THESE QUALITY PRODUCTS

AIRCRAFT SPARK PLUGS · AIR CLEANERS · AMMETERS · CARBURETOR INTAKE SILENCERS CARBURETOR INTAKE SILENCER AND AIR CLEANERS · DIE CASTINGS · DIE CASTING MACHINES FLAME ARRESTERS · FLEXIBLE SHAFTS AND CABLES · FUEL OIL FILTERS · FUEL PUMPS · FUEL AND VACUUM PUMPS · GASOLINE GAUGES · GASOLINE STRAINERS · IGNITION CABLE TERMINALS · INSTRUMENT PANELS · LUBRICATING OIL FILTERS · OIL FILTER REPLACEMENT ELEMENTS AND CARTRIDGES · AIR GAUGES · OIL GAUGES · RADIATOR PRESSURE CAPS REPLACEABLE AIR CLEANER ELEMENTS · AUTOMOTIVE SPARK PLUGS · SPARK PLUG CLEANERS SPARK PLUG GAPPING TOOLS · SPARK PLUG TESTERS · SPEEDOMETERS · SPEEDOMETER CABLES · TACHOMETERS · THERMO GAUGES · VACUUM PUMPS

AC

LET'S FINISH THE JOB— BUY VICTORY BONDS

Sealed — AGAINST WEAR AND TEAR

Spring freshets would like to drive logs and debris through a beaver's domain, and autumn's drought tries to steal his home away. So the beaver long ago turned engineer. He *seals* his dam against upsets—slaps sticks, leaves and mud into stout masonry.

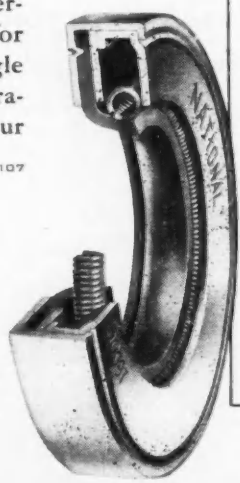
National Oil Seals work like beavers, at almost no cost, to keep lubricants *in* and hold dirt *out* of vital bearings and gears. Wherever shafts turn, in war machines or home industry, there's a job for Nationals. Built in the world's largest plants devoted to the single problem of oil retention, they can be "tailored" to fit any operation, large or small. There's a National engineer not far from your plant. Call him in.

1107

NATIONAL MOTOR BEARING CO., INC.

General Offices: Redwood City, Calif. • Plants: Redwood City, Calif., Van Wert, Ohio • Los Angeles, Calif. (Arrowhead Rubber Company)

NATIONAL
OIL AND FLUID SEALS



CALL IN A NATIONAL ENGINEER FOR RECOMMENDATIONS
No Obligation

CHICAGO
135 S. LaSalle St., Central 8663
CLEVELAND
3091 Mayfield Rd., Yellowstone 2720
DETROIT
1015 Fisher Bldg., Trinity 16363
MILWAUKEE
1717 E. Kane Place, Lakeside 2838
NEW YORK CITY
122 E. 42nd St., Lexington 28260
PHILADELPHIA
401 N. Broad St., Bell-Walnut 6997
LOS ANGELES
2244 E. 37th St., Kimball 6384
REDWOOD CITY, CALIF.
Bdwy. and National, Rdwd. City 3400

WHEREVER SHAFTS MOVE, THERE'S A NATIONAL OIL SEAL TO RETAIN THE LUBRICANT

RESEARCH

New forging techniques—developed by Ladish research — provide maximum strength in vital parts through controlled grain flow at points of greatest stress.

Ladish engineers are available for consultation on designing postwar products to higher limits of strength and safety through use of drop forgings.

DROP FORGINGS UP TO 3000 lbs.

ARMY-NAVY E

LADISH DROP FORGE CO.

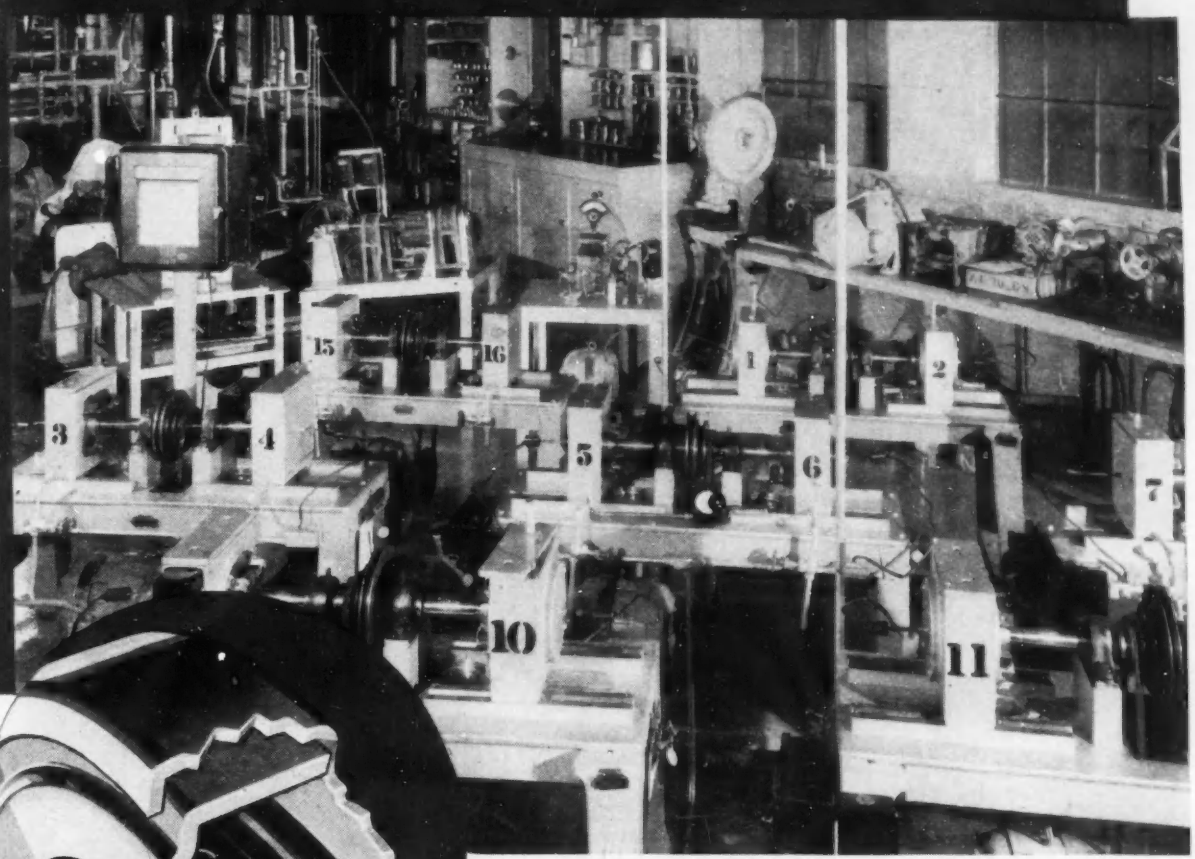
CUDAHY • WISCONSIN

MILWAUKEE SUBURB

TO MARK PROGRESS


MORE SPRINGS—BETTER SPRINGS
OFFSPRINGS of WAR
To give the devil his due, the urgent necessities of war forced rapid advances in equipment and techniques for producing *more* springs and *better* springs *faster* . . . often at less expense.
This organization played a major role in that development and our new knowledge and high speed mass production facilities are now at the service of manufacturers of peacetime goods.
If high grade mechanical springs are essential parts in your products, better check with our engineers to learn what can be done *today* . . . through re-design, new materials, new production methods . . . to improve performance, lower costs or speed delivery on many types of springs.
Your Inquiries Invited
GIBSON-SPRINGS
THE WILLIAM D. GIBSON CO.
DIVISION OF ASSOCIATED SPRING CORPORATION
1800 Clybourn Avenue Chicago 14, Illinois

Developed through research



. . . Controlled in production

Shown above is a section of Victor's laboratory devoted to the development and testing of oil seals. Units of the machines for which Victor seals are engineered are set up in this testing laboratory. Each seal design is carefully checked under conditions which simulate the actual job to be performed; shaft speeds, eccentricity, misalignment, lubricant temperature, and lubricant pressure are carefully duplicated. The seals on test are observed for thousands of hours to determine life performance.

. When material and design have been approved, the seals are put into quantity production. But the testing goes on continuously, from production samples selected at random. This production control assures maintenance of the high quality of all Victor oil seals.

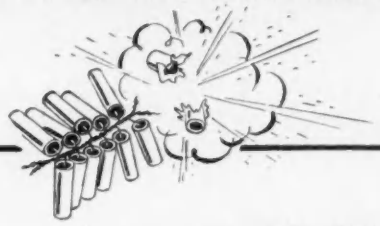
The facilities of this laboratory and the services of a competent, experienced technical staff are at the disposal of any manufacturer with a sealing problem. VICTOR MANUFACTURING AND GASKET COMPANY, P. O. Box 1333, Chicago, Illinois, U. S. A.

SEALING PRODUCTS *Exclusively*

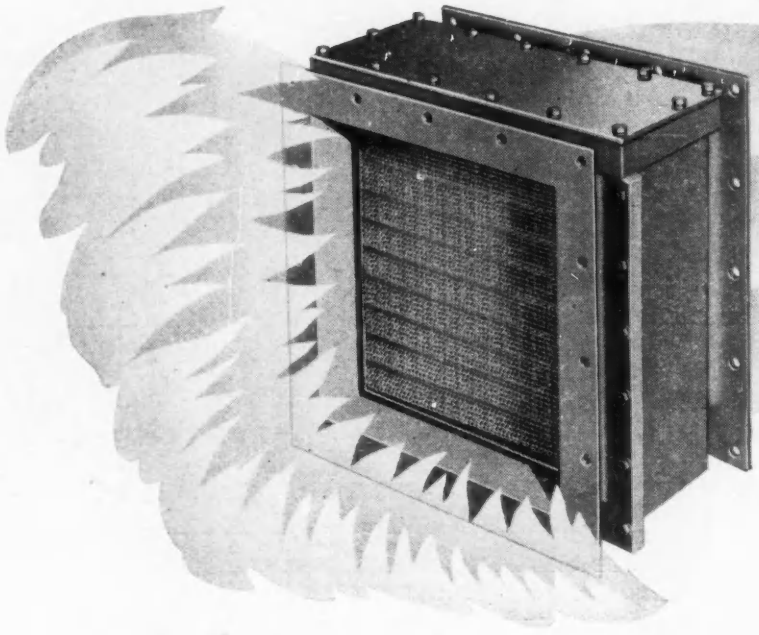
VICTOR

GASKETS • • OIL SEALS

WHEN ONE EXPLOSION CAN BREED ANOTHER...



THIS "SNUFFER" KEEPS FLAME FROM SPREADING



Air-Maze flame-arresting filter. Underwriters' Laboratories approved.

—another example of Air-Maze engineering

In mines, grain elevators, liquid storage holds of ships—perhaps in your own building or plant—one explosion may set off others like a string of firecrackers. Flames blasting through ventilators can start a dozen infernos in an instant.

Air-Maze engineers have now developed a flame and explosion-arresting panel only 4 inches thick. This "snuffer" is open enough to permit air to pass through freely, yet it has the amazing ability to prevent an explosion on one side from igniting even an air-gasoline mixture on the other side.

This flame-arresting "by-product" of 20 years of specializing in air filtration is typical of the thousands of unusual developments pioneered by Air-Maze engineers. Whether your problem has to do with ventilation, humidity control, flame arresting, intake air filtration and silencing or fine particle filtration of liquids—bring it to Air-Maze.

AIR-MAZE CORPORATION, Cleveland 5, Ohio. *Representatives in Principal Cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver, B. C.*

IF IT USES AIR . . . USE

AIR-MAZE

ENGINEERED AIR FILTRATION

• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne dirt, oil, grease and liquids • Oil-wetted type filters and filter-silencers • Exhaust spark arresters • Gear case, crankcase and tank vent breathers • Oil-separators for engine crankcases • Full-flow type cleanable oil filters

EASILY INSTALLED—NO CEMENT

In three easy and clean operations the windows and windshield of your motor vehicle or airplane are weather-proofed with the new, revolutionary Inland Self-Sealing Weather Strip.

Gone is the necessity of using cement, which in time deteriorates—it is replaced by a mechanical lock which provides permanent weather-proofing.

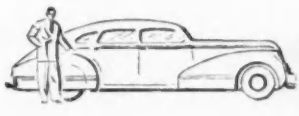
Inland's Self-Sealing Weather Strip is sealed to the glass and held firmly in place by a heavy rubber pressure band, which is quickly threaded with a zipper-like motion around the outer surface of the stripping. The pressure of this inserted band holds the glass firmly in place to withstand all normal pressures.

Use of the Inland Patented Weather Strip eliminates need for expensive channels and mouldings, thus simplifying body construction and reducing assembly labor costs. These economies give credence to the belief that this weather strip will be a "must" in future designs.

Produced in colors . . . red, green, yellow, blue, tan, cream, orange and gray . . . this weather strip adds beauty, and may be blended with the body color. Standard sizes available. Special sizes can be obtained upon order.

Learn more about this money-saving, labor-saving, self-sealing weather strip. For details and prices write to—

INLAND MANUFACTURING DIVISION • General Motors Corp., Dayton, Ohio

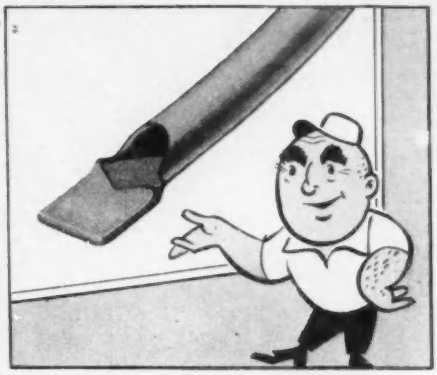


INLAND Manufacturing

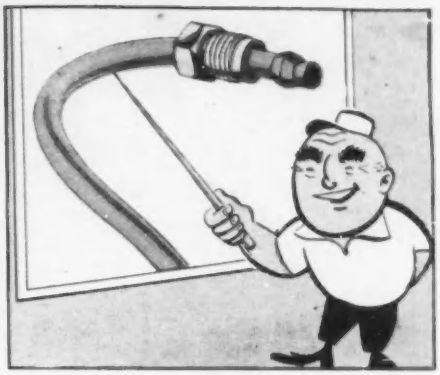
RUBBER, METAL, PLASTICS

SEE HOW EASILY BUNDYWELD IS FABRICATED

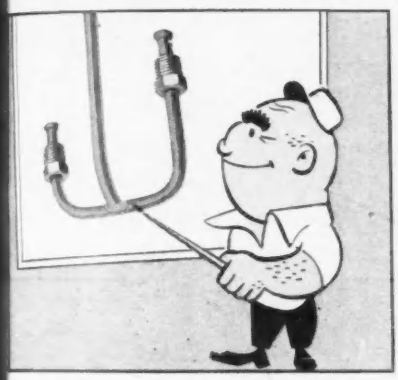
1 THIS SMALL PIECE of Bundyweld is double upset, flanged, expanded and notched.



2 A NOTCHED and flattened end is simple with Bundyweld Steel Tubing.

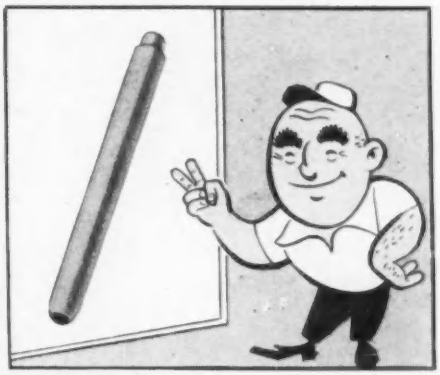


3 SHARP BENDS are easily made without flattening. Note the use of compression fittings.



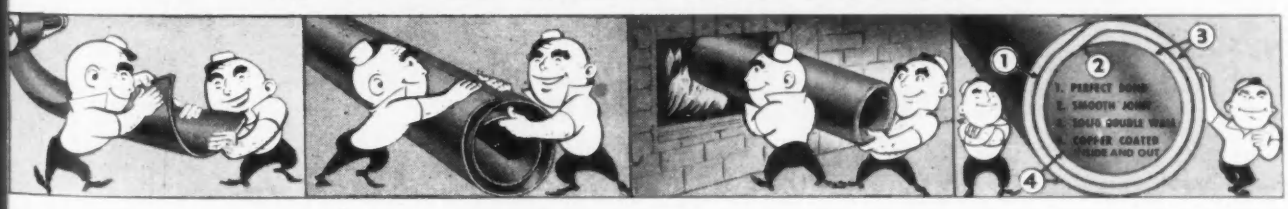
4 THIS PART shows how Bundyweld may be saddle flanged, pierced and silver soldered together for a right angle connection.

5 SMALL TUBES take the double flare as readily as the larger sizes. This part fabricated from 3/16" O.D. Bundyweld.



6 TWO SCREW MACHINE operations . . . a sharply cut shoulder at one end and shaping for ball seat at the other end.

AN UNUSUAL MANUFACTURING PROCESS



1 Bundyweld Tubing is made by a process entirely different from that used in making other tubing. A single strip of copper-coated S.A.E. 1010 steel is continuously rolled twice laterally . . .

2 . . . into tubular form. Walls of uniform thickness and concentricity are assured by the use of close tolerance cold rolled strip. This double rolled strip passes through a furnace where the . . .

3 . . . copper coating fuses and alloys with the double steel walls. After brazing and cooling, it becomes a solid double wall steel tube, copper brazed throughout 360° of wall contact . . .

4 . . . copper coated inside and out, free from scale, closely held to dimensions. Hard or annealed in standard sizes up to 5/8" O.D. Special sizes cold drawn. Also in Monel and nickel.

BUNDY TUBING

ENGINEERED TO YOUR EXPECTATIONS

BUNDY TUBING DISTRIBUTORS AND REPRESENTATIVES:

Pacific Metals Co., Ltd.
3100 19th St.
San Francisco 10, Calif.

Standard Tube Sales Corp.
1 Admiral Ave.
Maspeth, N.Y.C., N.Y.

Lapham-Hickey Co.
3333 W. 47th Place
Chicago 32, Illinois

Rutan & Co.
112 S. 16th St.
Phila. 2, Pa.

Eagle Metals Co.
3628 E. Marginal Way
Seattle 4, Wash.

Alloy Metal Sales Ltd.
861 Bay St.
Toronto 5, Canada

"Balling out" a tube is a Precision Operation

Our business is bending tubes. It's an exacting, intricate job. Some tube bends must be made so accurate that "balling out" is necessary.

This is an important process of precision where a tube is placed in a die and steel balls of uniform diameter are forced through every bend so that every part of the curved and straight sections is standard and each tube is a counter part of every other tube in the same lot.

This is a typical example of the unusual care that characterizes every step in the bending of every tube at the American Tube Bending Company, Inc.—from the tiniest of oil lines to a five-inch exhaust manifold.

If you have a tube bending job that calls for this kind of care, entrust it to us. We have had a proud record for reliability and stability—for the past 35 years.

Write for informative booklet "Precision in Tube Bending" to the American Tube Bending Company, Inc., 6E Lawrence Street, New Haven 11, Conn.

AMERICAN TUBE BENDING COMPANY, INC.

PRECISION to aircraft standards

PORTAGRAPH shortens distance from research to production

INSTRUCTIONS: PHOTO-ACCURATE

DATA FOR RESEARCH

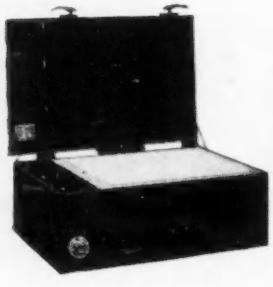
A section of the photographic darkroom of the Jessop Steel Company of Washington, Pa., makers of specialty steels since 1901. The Portagraph, located adjacent to the metallographic microscope, is shown preparing instruction sheets for heating and rolling a special type of alloy steel.

● The speed and accuracy tha Portagraph photo-copy machine h to all kinds of reproductions have greatly in the vital functions perfo by the Research Department o Jessop Steel Co., Washington, P

Portagraph is used in the meta gical laboratory for contact printi photographic negatives and phot crographs, for copying data and ins tions to be used in the mill. Bluepr tracings, excerpts from technical b and papers are rapidly reproduced ways with the assurance that c will be "picture-perfect."

"We consider our Portagraph of the most useful pieces of equip in the department," writes J. L. Kl Jessop's Research Metallurgist. "Ab all, we like the accuracy and readabi with which reproductions are mad

Portagraph provides valuable savi in time when there is copying to done. Its simplicity of operation p mits even a novice to do perfect w in a very short while. And Portagra makes prints at only a few cents ea



20"x24"—Contact photo-copies are quick, easy, inexpensive to produce on the G-11 Portagraph shown above. Electrical micro-matic timing switch insures perfect results with inexperienced operators.

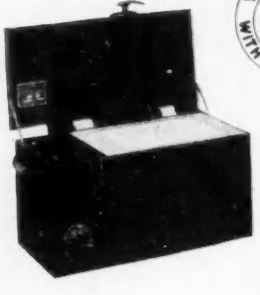
SPEED - VERSATILITY - SIMPLICITY - ECONOM

YOU CAN COPY BETTER WITH PHOTOGRAPHY

REMINGTON RAND

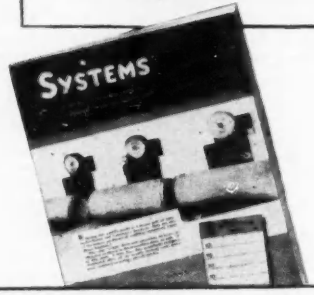
PORTAGRAPH

PHOTO-COPY



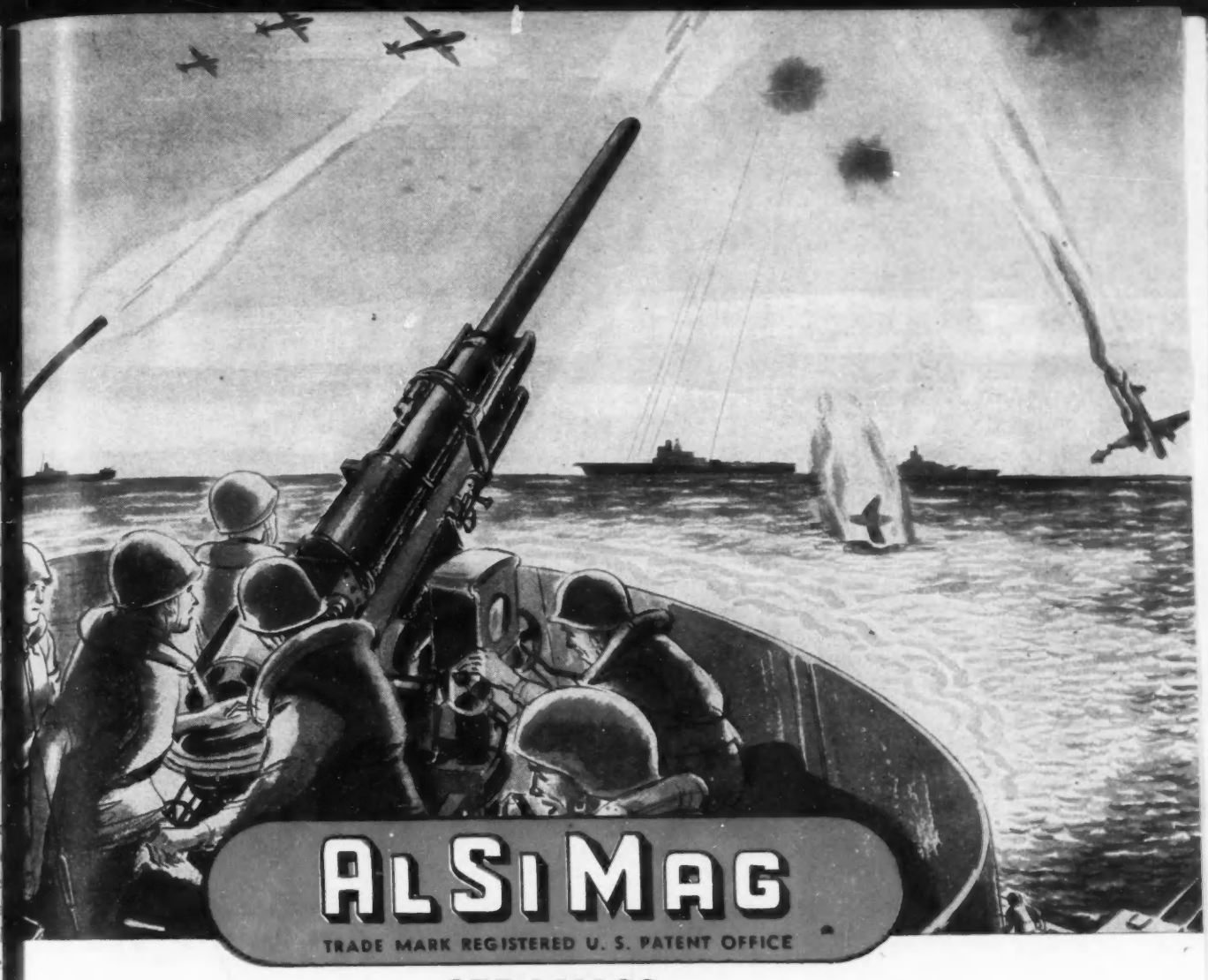
9½"x15"—the G-10 Model Portagraph can be set up anywhere. Electrical timing switch guarantees uniform excellence of reproduction from copy of any description. A similar model handles copies up to 20" x 24".

G-13 ROTARY PORTAGRAPH has a reproduction capacity of 42" in width by any length. Unsurpassed for making photo-copies in large volume.



WRITE TODAY—The February issue "Systems" Magazine contains full deta of the Jessop Steel Company's use of bu ness photography in the coordination plant activities. Ask our nearest Bran Office for a copy or write us in New Yor

PHOTOGRAPHIC RECORDS DIVISION, REMINGTON RAND, 315 FOURTH AVENUE, NEW YORK 10, N. Y



CERAMICS SO RUGGED THEY COULD WITHSTAND THE SHOCK OF BEING FIRED FROM A GUN WITH A FORCE OF 20,000g in the 'RADIO PROXIMITY FUSE'

War's Number 2 Scientific Development

ALSIMAG Ceramic Insulators were extensively used in condensers for the 'Radio Proximity Fuse' described by high Navy officials as second only to the atomic bomb among the greatest scientific developments of the war. Development of the fuse required production of electronic parts so rugged they could withstand the shock of being fired from a gun with a force 20,000 times that of gravity. The components had to be so small that a complete unit could be installed in the nose of a projectile.

The fuse, developed at a cost of $800,000,000 is an extremely rugged, five tube radio sending and receiving station which fits into the nose of a projectile. Reflected impulses explode the projectile when it passes within 70 feet of enemy planes.

The 'Radio Proximity Fuse' was the effective answer to Japanese suicide plane attacks, as well as buzz bomb attacks on London.

American Lava Corporation is justly proud of the fact that it was able to provide the Ceramic Insulators capable of withstanding the tremendous shock of being fired from a gun in the 'Radio Proximity Fuse.'

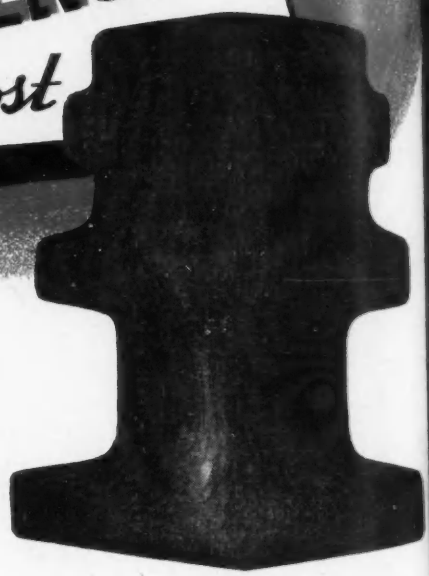
Whatever you are planning in the electrical or electronic field, we believe our specialized knowledge, research and production facilities will prove helpful. Let's work together.

ALCO has been awarded for the fifth time the Army-Navy 'E' Award for continued excellence in quantity and quality of essential war production.

AMERICAN LAVA CORPORATION
CHATTANOOGA 5, TENNESSEE

43RD YEAR OF CERAMIC LEADERSHIP

Forgings Provide ADDED STRENGTH where it is needed most



The invaluable added strength that is imparted by forging to both the machine as a whole and to the desired sections of forged parts, cannot be secured by any other process.

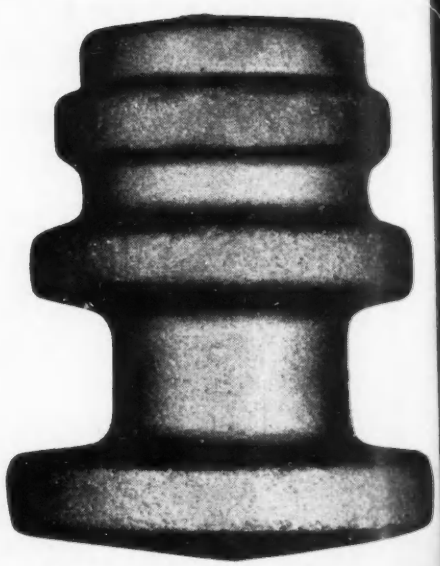
The high-speed, heavy duty machines of today require steel at its ultimate strength to assure safe, dependable, trouble-free operation. Maximum metal quality is attained in forgings; especially for these parts which are subjected to tensional, torsional and compression stresses. The superior fatigue resistance of forgings, retained to a high degree after repeated stresses, enhances the useful life of the machine in which they are employed.

In many machine parts, some sections are subjected to greater shock and stress than others. Naturally then, it has become common practice for users of forgings to specify the directioning of the grain flow to meet the shock and stress recurring under actual service conditions. Proper designing of dies and modern day forging practice make it possible to develop the grain flow in the desired directions, as shown in the micro-views herewith. With controlled grain flow, the metal is compacted into a dense mass of high strength and toughness at the critical points. This characteristic, obtainable only in forgings, is of special value in parts subjected to fluctuating or reversing loads, impact or similar working stresses.

The engineering department of Kropp Forge Company will gladly consult with machine designers on stress problems.

Whenever you need flat die, drop or upset forgings, call your nearest Kropp engineering representative or send your prints direct for immediate quotation.

The fiber flow lines indicate the added strength at points of greatest shock and stress obtained in the forging shown below.



KROPP FORGE COMPANY
5301 W. Roosevelt Road Chicago (50), Illinois
Engineering Representatives in Principal Cities

SERVING INDUSTRY 18 SINCE 31 K KROPP FORGE CO OVER 100 YEARS

KROPP

"FORGINGS TO EVERY SPECIFICATION"

LOWER COSTS for BETTER PRODUCTS

with Acme-Gridley CHUCKERS

Let's look ahead six months or a year, or two ears—to the time when war production is inished.

Nation-wide plant capacity will be greater han ever before. We can make more goods than easonable demand can absorb.

With material and labor costs about the ame in all plants, isn't it logical to look upon *me of production* as the one controllable factor setting up competitive prices?

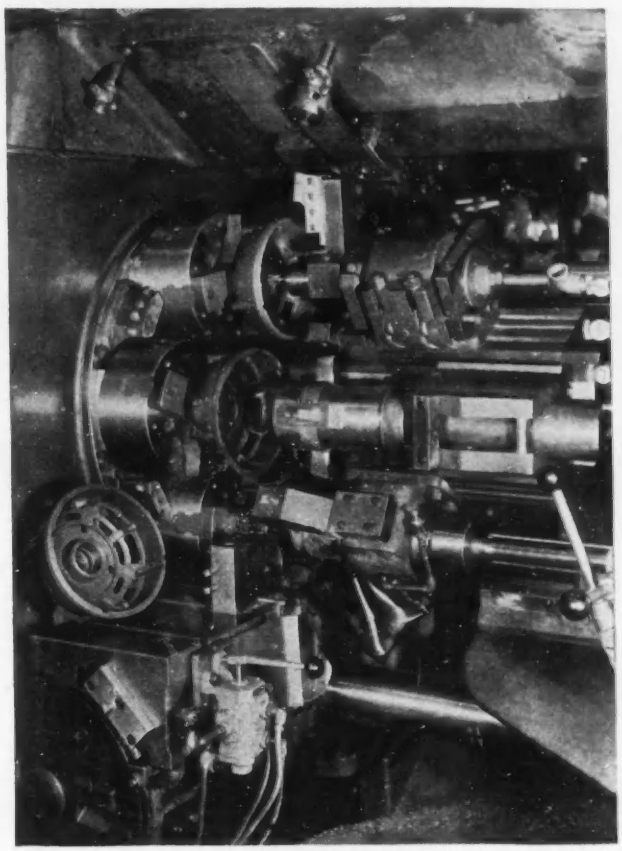
Here is a typical example:

The part is a cast iron motor bracket, 10½" diameter. There are many ways to do the 14 perations necessary to finish this part.

On a 12" Six-Spindle Acme-Gridley Chucking Automatic, using carbide-tipped tools, machine ime for all 14 operations was cut to *less than minute.*

That's the way Acme-Gridley Chuckers can elp you achieve lower competitive selling prices—by producing your precision parts in ess time.

Acme-Gridley Chuckers are universal ma-hines—not special one-purpose tools.



Booklet "How Costs Were Cut on 25 Chucking Jobs" shows their broad-range adaptability. Send for your copy.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

COLLETS AND PUSHERS

The design, materials and methods of processing GENUINE Acme-Gridley Collets and Pushers are vital to continuous low-cost performance on your Multiple Spindle Automatics.

Bulletin CP-45

To Resist PRESSURE and HEAT and COLD

• That's what refinery fittings have to do. They carry hot—or cold—liquids and gases under high pressure. They must resist "creep"—hold their dimensions. They must resist corrosion.

So we make refinery fittings—manifolds, return bends and valves—of cast steel, because cast steel has the desired properties, and because these properties can be specified in advance. And cast to complex shapes.

Do your steel parts call for entirely different properties? Whatever they are, you can get them in cast steel.

Research and experience have given steel foundries plenty of modern "know how". And performance—in both war and peace—has proved the value, the versatility and the economy of steel castings.

For steel parts of whatever size or shape, with mechanical properties the conditions require, consult your steel foundryman. Or write to Steel Founders' Society, 920 Midland Bldg., Cleveland, Ohio.

MODERNIZE AND IMPROVE YOUR PRODUCT WITH

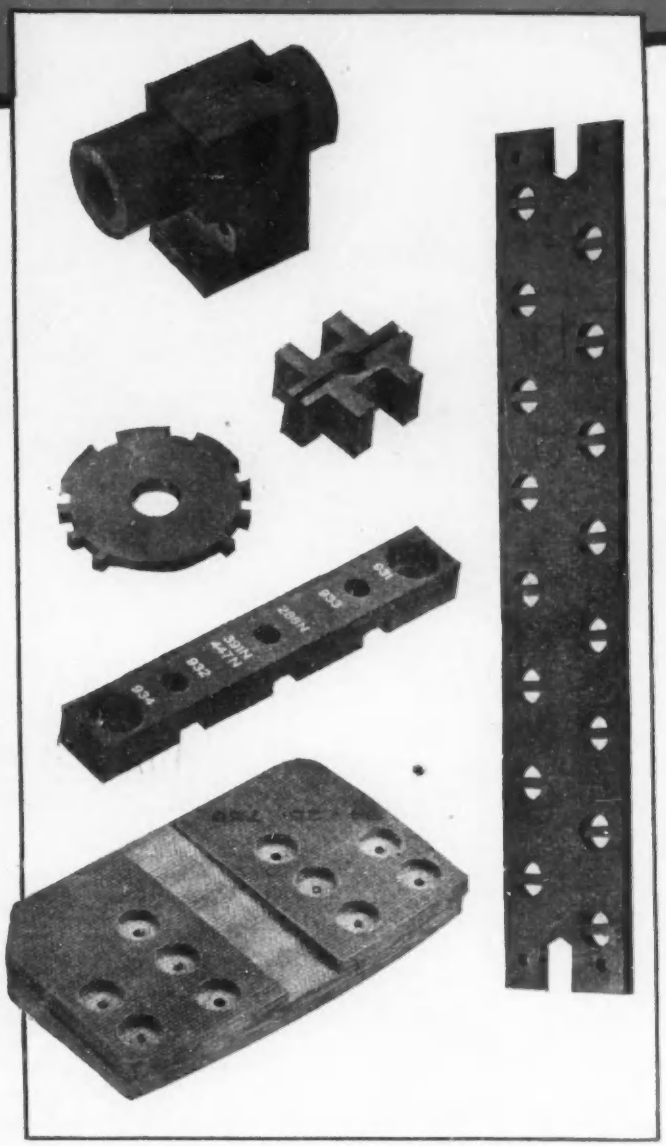
STEEL CASTINGS

Use Panelyte Fabricated Parts where corrosion is a Problem

Panelyte laminated plastic parts are not affected by water, brine, oil, ordinary solvents, coolants, ketones, esters, weak acids or alkalis. Having good electrical properties combined with unusual structural strength, dimensional stability, and excellent heat resistance, Panelyte is thoroughly dependable and adaptable. Easily machined to exact specifications, weight-saving Panelyte parts are mass-produced in our new plant.

Our policy of working closely with customers' engineering departments enables us to give designing aid, and from performance data on hand, to make accurate estimates on the service life of proposed applications.

Inquiries are invited on sheets, rods, tubes, and *molded* as well as fabricated parts. Write for factual "Engineering Data Book".



Typical examples of lathe turning, grooving, printing, milling, shaving, and die-punching.

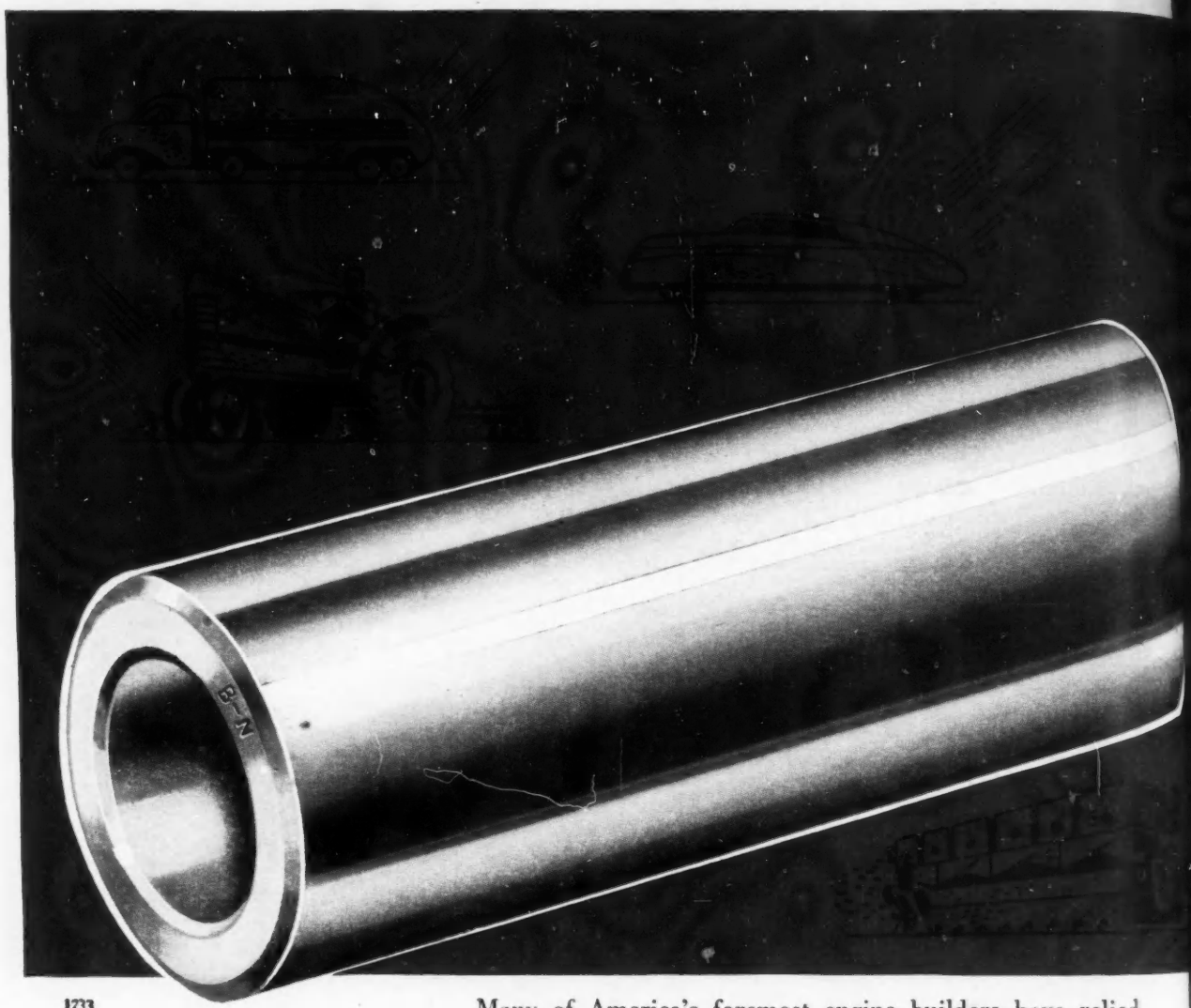
PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Nashville, New Orleans, Phoenix, Portland, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Trenton: Buenos Aires, Johannesburg, Mexico City, Montreal, San Jose, Sao Paulo, Sydney, Toronto, Vancouver.

★ **MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, ASBESTOS BASE LAMINATES; DECORATIVE GRADES**

Burgess Norton PISTON PINS FOR ALL ENGINES...



1233

Many of America's foremost engine builders have relied upon B-N pins through the years . . . their reliance on Burgess-Norton year in and year out can be ascribed to the rigid adherence to this production slogan:

Always better than specifications!

For over 20 years a supplier of parts and assemblies to the automotive industry; specialists in Piston Pins and Clutch Plates for cars, trucks, and tractors.

Burgess Norton
MANUFACTURING COMPANY
42 years in GENEVA, ILLINOIS

A Part is Never Made Right Unless it is Satisfactory to Our Customer

Yesterday's Air Mile Is Only 528 Feet Today!

IN a short span of years Thompson Products has seen great changes and has contributed much to the development of crude "flying machines" into the sky giants of today.

The job of stepping-up the bumpy air rides of 30 miles per hour into the smooth cruising flights of over 300 miles per hour has been one of reducing pounds per horsepower.

Today, we are building precision parts for the jet propulsion and gas turbine engines. Some day, who knows, we may be producing parts for still smaller and more compact engines that will harness atomic power . . . less pounds per horsepower—that man may fly farther, faster—safer.

Thompson Aircraft Parts and Accessories are used as original equipment by nearly every aircraft and aviation engine builder in the United States including:

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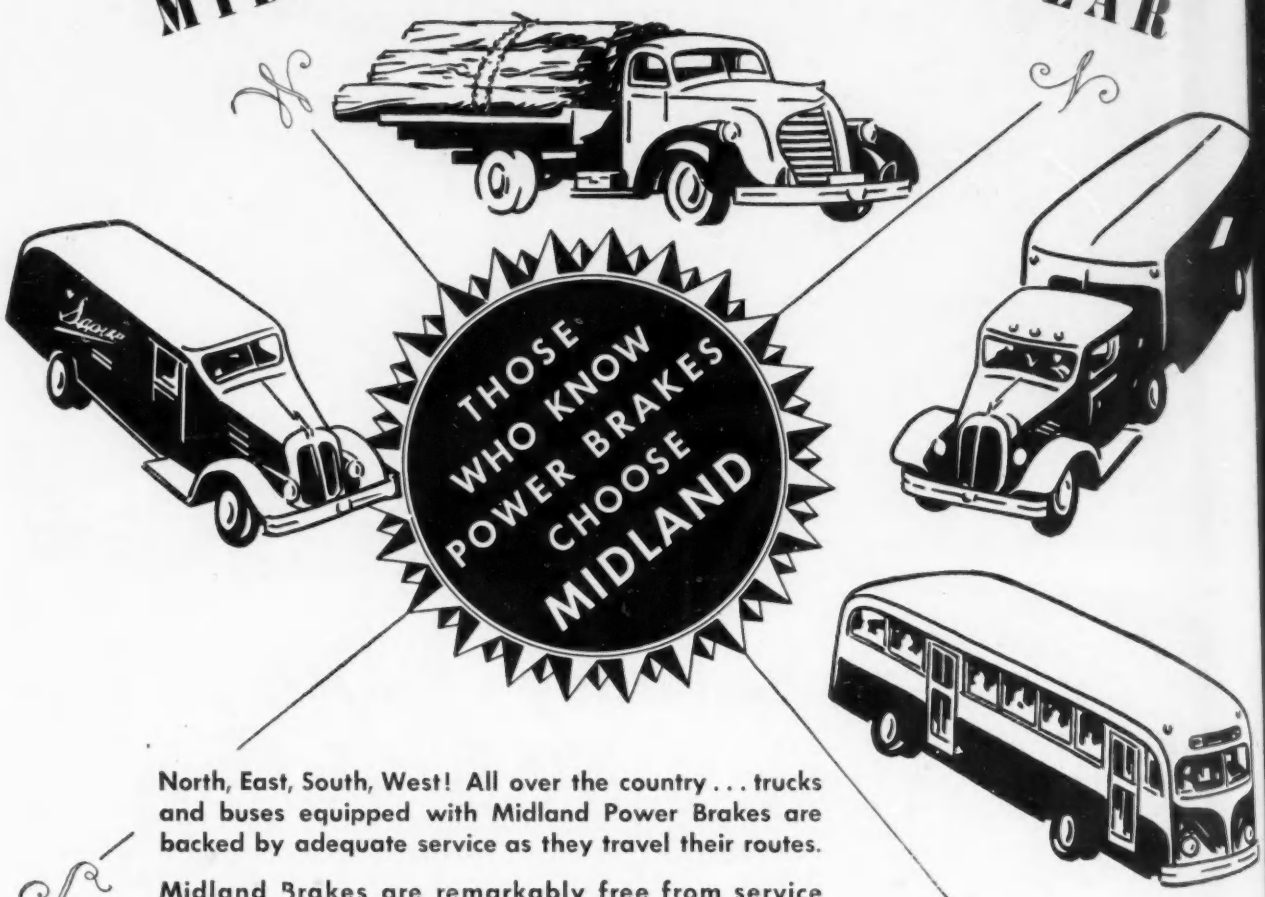
ALLISON • AXELSON • CHURCH • CONTINENTAL • CURTISS PROPELLER • JACOBS • KINNER MOTORS, INC. • LAMBERT • LE BLOND • LYCOMING • MENASCO • MILWAUKEE • PRATT & WHITNEY • RANGER • ROLLS-ROYCE • WRIGHT

Thompson Products, Inc.

CLEVELAND • DETROIT • LOS ANGELES

Wherever Trucks and Buses Roll

MIDLAND SERVICE IS NEAR



North, East, South, West! All over the country . . . trucks and buses equipped with Midland Power Brakes are backed by adequate service as they travel their routes.

Midland Brakes are remarkably free from service requirements, but it's a satisfaction to know that dependable service is near, if needed. There are one or more Midland Distributors or Dealers in key cities from coast to coast.

Safeguard your equipment with Midland Power Brakes. See the Midland Distributor near you, or write to us for complete information.

THE MIDLAND STEEL PRODUCTS CO.
10619 MADISON AVENUE, CLEVELAND 1, OHIO
Export Department: 38 Pearl Street, New York City

NOTE: A newly acquired plant makes it possible for us to consider the post war manufacture of a few items in household or office appliance, automotive or mechanical fields, in small or medium size fabrications. We invite inquiries to MIDLAND NEW PRODUCTS DEPT., at the address at the left.

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POWER BRAKES

MORE THAN 15,000,000 MICROMOTORS

In twenty years the Redmond Company has become an outstanding leader in the manufacturing of small fractional horsepower motors.

Redmond COMPANY, Inc., OWOSSO, MICHIGAN, U. S. A.

A. C. Micromotors in sizes up to 1/25th horsepower, D. C. Micromotors up to 1/20th horsepower, Speed Controllers, and Blowers.

Today the combined Redmond facilities include more than five acres of floor area and 2000 employees.

SELF-ALIGNING

HALFCO SPHERICAL BEARINGS

Made with only **two pieces** . . . a one-piece bronze outer race and a hard-chrome plated steel ball!

HALFCO SPHERICAL BEARINGS combine higher load capacity and a higher degree of mis-alignment with more projected bearing area **than any other self-aligning bearing!** The only compact, **two-piece** self-aligning bearing, HALFCO SPHERICAL BEARINGS are now off the Critical Materials list and available in any quantity!

When rigidity is difficult and expensive to attain, or wherever alignment is a problem, specify war-tested HALFCO SPHERICAL BEARINGS

Write or wire TODAY for full engineering information about HALFCO SPHERICAL BEARINGS, and their present and future uses!

A few of the many rod ends available fitted with HALFCO SPHERICAL BEARINGS.

HALFCO BEARINGS

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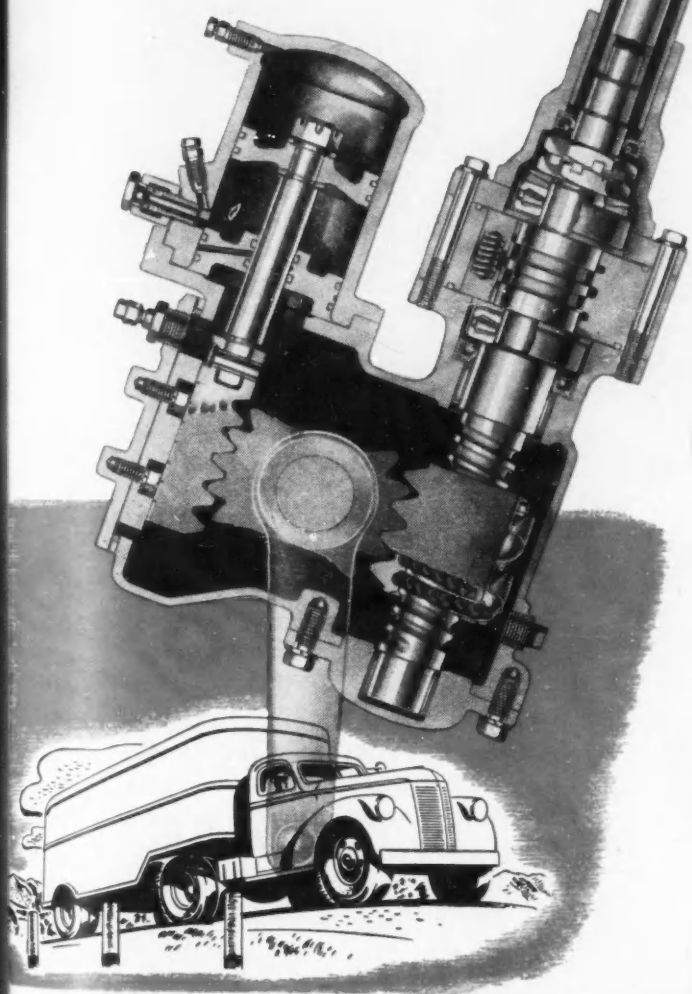
ENGINEERS · · · MANUFACTURERS

5341 SAN FERNANDO ROAD WEST · LOS ANGELES, CALIFORNIA

Saginaw HYDRAULIC POWER STEERING GEAR

is highly efficient... thoroughly dependable



Saginaw hydraulic power steering gear, compact in design and built for long life, combines the components of the modern conventional heavy-duty steering gear with a double-acting hydraulic cylinder and control drive. Hydraulic pressure is provided by a pump, either engine-driven or with an electric motor—whichever best suits the application.

After a predetermined amount of physical effort has been applied, operation of the steering wheel opens or closes the control valve, causing the power cylinder to exert additional hydraulic help to the output shaft. This power actuation is obtained without in any way disturbing the positive mechanical line of control from steering wheel to road wheels. *This means that complete mechanical control by manual effort remains available for emergency use.*

With the Saginaw hydraulic steering gear, the power applied by the hydraulic mechanism is directly proportional to the resistance to steering movement offered by the front wheels. This permits the driver to retain the "feel" of the road, with good directional stability . . . practically eliminates road-shock and wheel-fight, because the hydraulic cylinder automatically resists the tendency to deflect the front wheels.

With easy maneuvering and perfect control under all conditions, the Saginaw steering gear does not interfere with conventional gear recovering or straightening after a turn. Write today for complete information. Whatever your requirement, the Saginaw hydraulic steering gear is right for the application.

If it's easy to steer—it's a Saginaw gear

Saginaw Steering Gear

DIVISION, GENERAL MOTORS CORPORATION, SAGINAW, MICHIGAN.

MANUFACTURER OF STEERING GEAR ASSEMBLIES • STEERING LINKAGE ASSEMBLIES • PROPELLER SHAFTS • DIESEL ENGINE AND AIRCRAFT PARTS

AT BETHLEHEM IT'S *Steel* PLUS *Service*

An important division of Bethlehem's business is the making of high-grade carbon and alloy steels for every purpose. But it has always seemed to us that the proper handling and treatment of steel is as vital as the quality of the product itself.

To that end, Bethlehem offers the services of its technicians on problems involving analyses, heat-treating, and applications. It is a common thing for Bethlehem "trouble-shooters" to visit customers' plants, suggest the proper alloy for a given job, and discuss questions of hardenability, grain size, machining, etc.

During the war years, this service was accelerated in the interests of victory. The net result was two-fold: (1) a speed-up of production in many, many instances; (2) a fund of experience that is enabling our metallurgists to render even greater help during this reconversion era.

Bethlehem's customer relations are by no means confined to the sale of steel. If you have a problem that relates to steel, why not get in touch with us? You'll find that we offer both steel *and* service.

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
Bethlehem Steel Export Corp., New York

★ BETHLEHEM STEEL ★

Brad Foote Gears
FOR
SPEED REDUCERS

RATIOS

HERRINGBONE	2:1 to 295:1
WORM	3⅜:1 to 60:1
GYRO	16:1 to 30,000:1
SPUR	2:1 to 40:1
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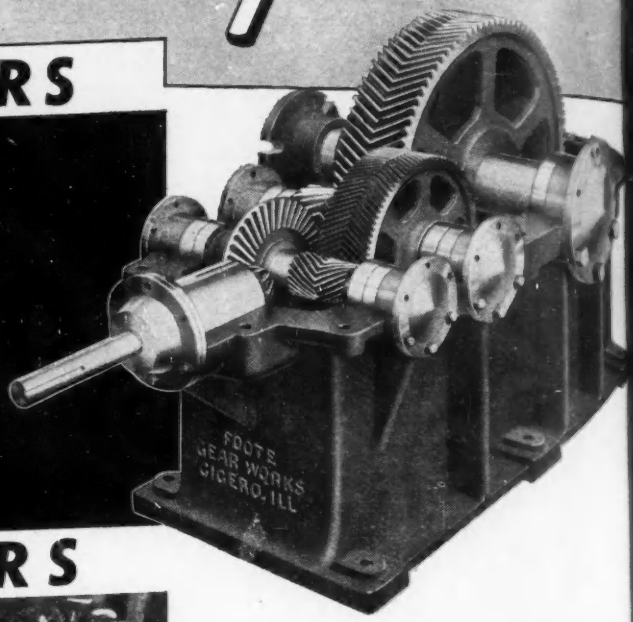
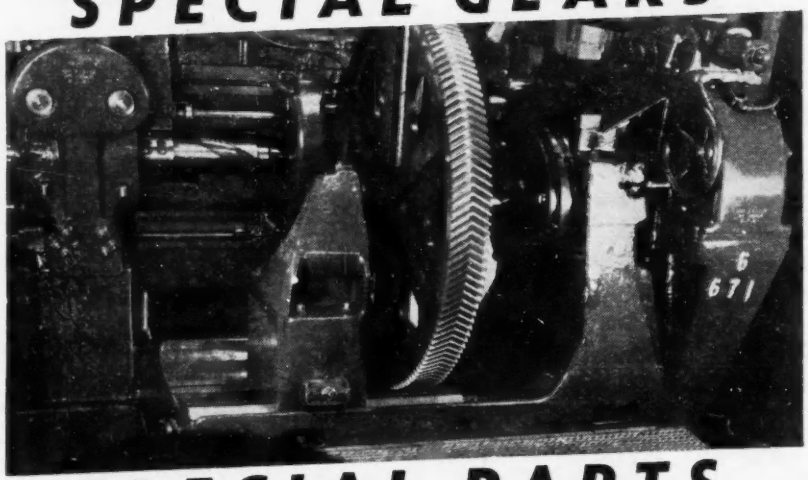
SPIRAL BEVEL	1:1 to 5:1
PLANETARY	4:1 to 400:1
OIL WELL UNITS	12:1
LITTLE GIANT	28:1



SPECIAL GEARS



Brad Foote diversified and extensive equipment permit the manufacture of all types of special precision cut gears.

Bevels, Straight, Spiral or Mitre, Spur, Herringbone, Helical are made at Brad Foote in any practical size from any practical material.

Gears are under constant inspection and close control and prompt deliveries may be made in any proportion.

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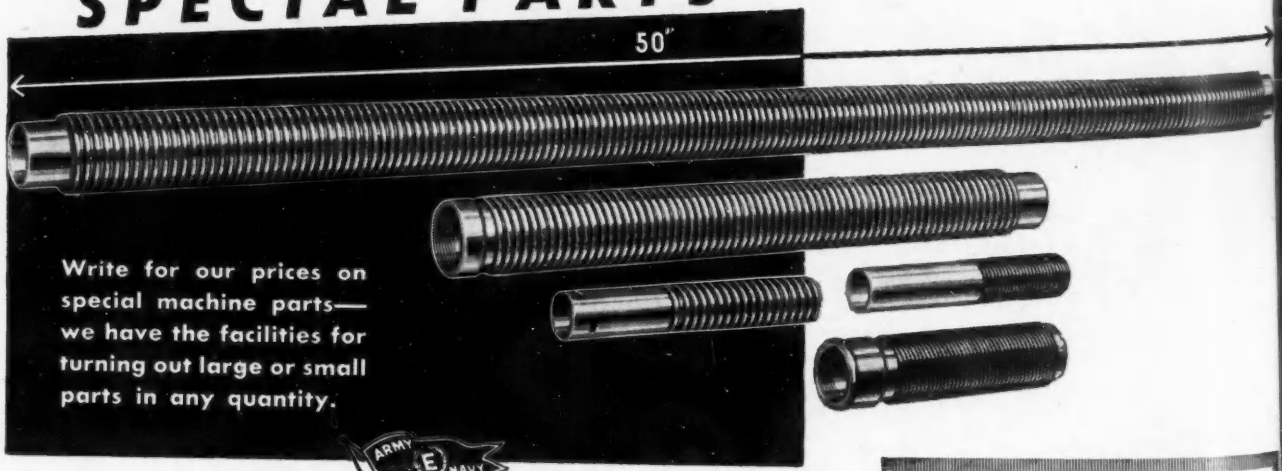

Write for our prices on special machine parts—we have the facilities for turning out large or small parts in any quantity.

ARMY E NAVY

BRAD FOOTE GEAR WORKS

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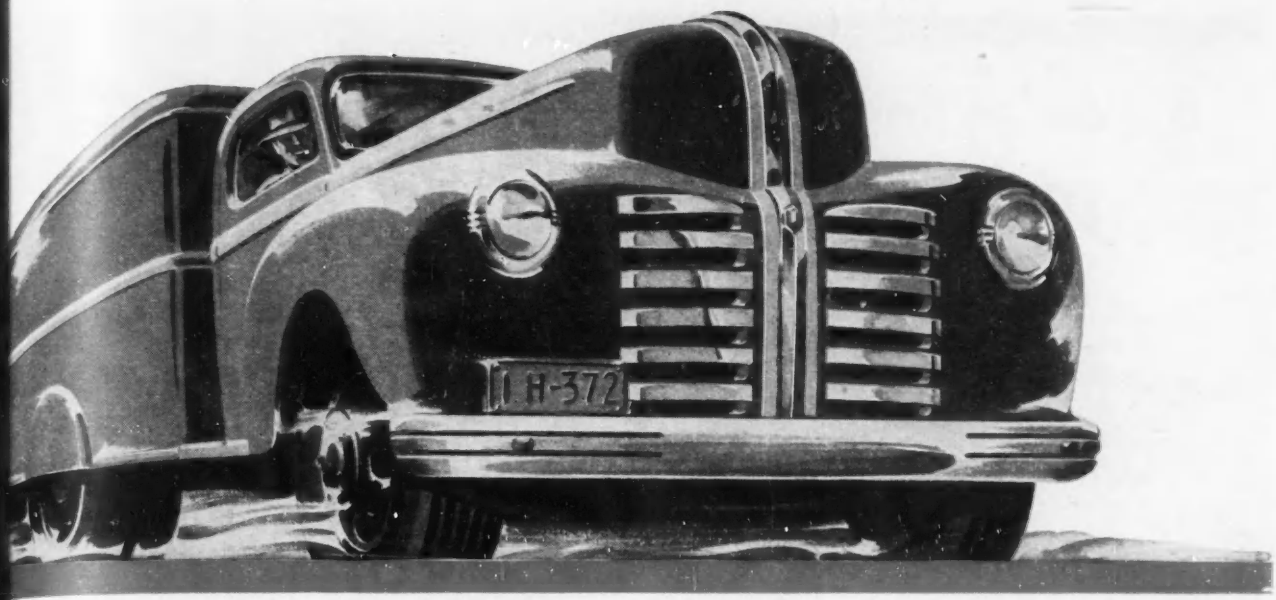
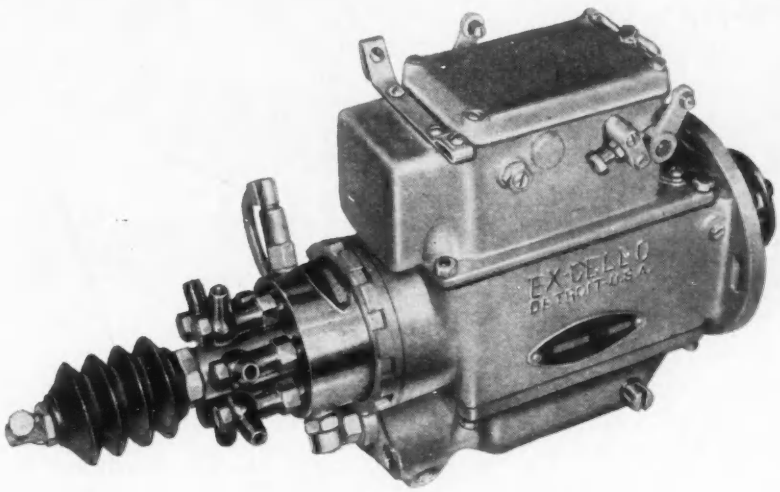
DEPARTMENT E, CICERO 50, ILL.



In War or Peace . . still Dependable



Fuel Injection Equipment for DIESEL Power

EX-CELL-O Fuel Injection Equipment is again ready to do a peace-time job for Diesel Engine Builders.

The Type KB Ex-Cello-O Fuel Injection Pump for variable speed applications features automatic timing that provides maximum power output and minimum fuel consumption.

A worthy complement to the KB pump is the Ex-Cell-O Nozzle. Backed by seventeen years of research and production, it is designed for trouble-free service.

Write Ex-Cell-O today for complete information.

Fuel Injection Division

EX-CELL-O CORPORATION DETROIT 6, MICH.

EX-CELL-O

QUICKER THAN YOU CAN SAY:

"Lift-O-Matic!"

• You flick the button with your little finger. Your hand hardly leaves the wheel. Your eyes never leave the road.

• Up—or down—flashes your car window in the wink of an eye—two-*tenths* of a second—the result of harnessed air power induced by vacuum.

That's how *fast,* how convenient, the Lift-O-Matic is.

The Lift-O-Matic eliminates the distraction and hazards of winding windows up or down by hand crank. You can ventilate, shut out air roar and drafts at higher road speeds, ward off the road splash of passing vehicles, and, for parking, seal the car from dust, snow or rain—and thieves—ALL with the quick touch of a button.

Ready now for the car of tomorrow, the perfected Lift-O-Matic is the product of 25 years of engineering and research devoted to the manufacture of millions of vacuum-operated mechanisms.

ALL CONCEALED WITHIN THE DOOR

TRICO *Lift-O-Matic*

TOUCH BUTTON CONTROL of Motor Car Windows thru HARNESSED AIR POWE

FOR TRAILERS, Fluid Heat Midget Furnaces permit coupling and uncoupling of trailers without fussing with fuel lines. Controls can be remote or mounted on heater. Model shown delivers 15,000 BTU per hour, measures 7⅝" x 10¼" x 16". Other models up to 40,000 BTU.

FOR TRUCKS AND BUSES, Fluid Heat Midget Furnaces are controlled from the dash, draw fuel from the vehicle's fuel tank.

Here's BIG HEATING CAPACITY in Small Units for Many Mobile Uses . . .

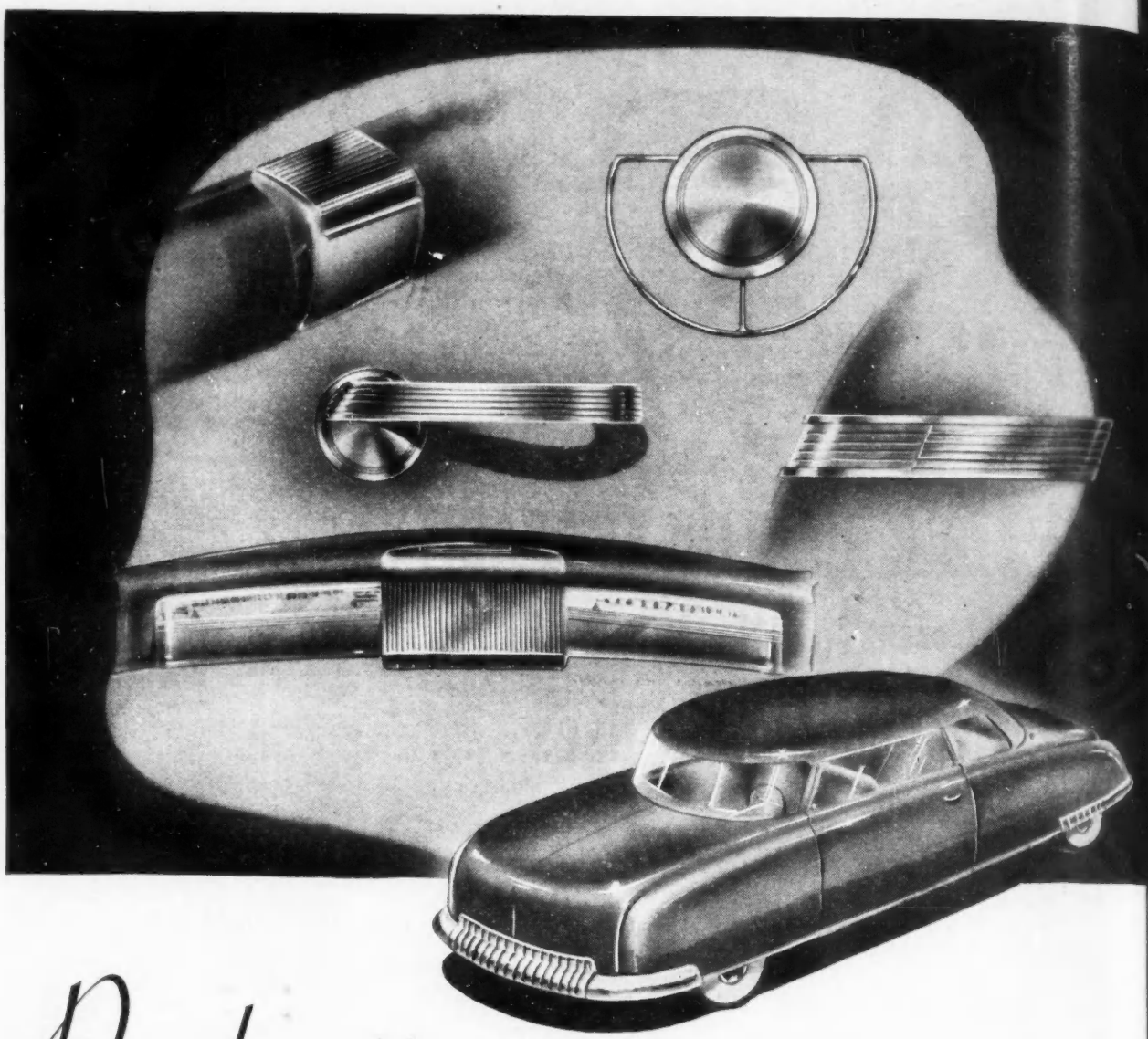
Fluid Heat Midget Furnaces—extensively used by the armed forces—suggest a wide variety of peacetime uses and may solve a problem for you when they become available for civilian use.

For example, you can use these efficient, compact units to keep freezable cargoes safe from cold . . . to heat personnel or cargo space in trucks, trailers, buses, ambulances, freight cars, boats, buildings or other space units . . . as portable aircraft heaters . . . as portable pre-heaters for truck, aircraft or other engines.

Employing our exclusive *Vapor Entraining* combustion process, these Fluid Heat Midget Furnaces burn gasoline with great flame stability. And behind this development stand Fluid Heat's 17 years of leadership in the design and manufacture of automatic combustion and heat transfer equipment.

We are genuinely interested in discussing your present and postwar heat applications. Write to us, tell us your requirements, and we will do our best to serve you. Address: FLUID HEAT DIVISION, Anchor Post Fence Co., 6770 Eastern Ave., Baltimore 24, Maryland.

fluid heat
MIDGET FURNACES
THE MIDGET THAT DOES A GIANT'S JOB



Perfection of appearance, as well as perfection in per formance, is a credo of the makers of America unexcelled automobiles.

Decorative Automobile Hardware plays an im portant part in the perfected appearance of th modern car. Precision made, beautifully finished Hardware of Metal Stampings and Die Cast Parts by Jacobs, are used by many manufacturers

by Jacobs

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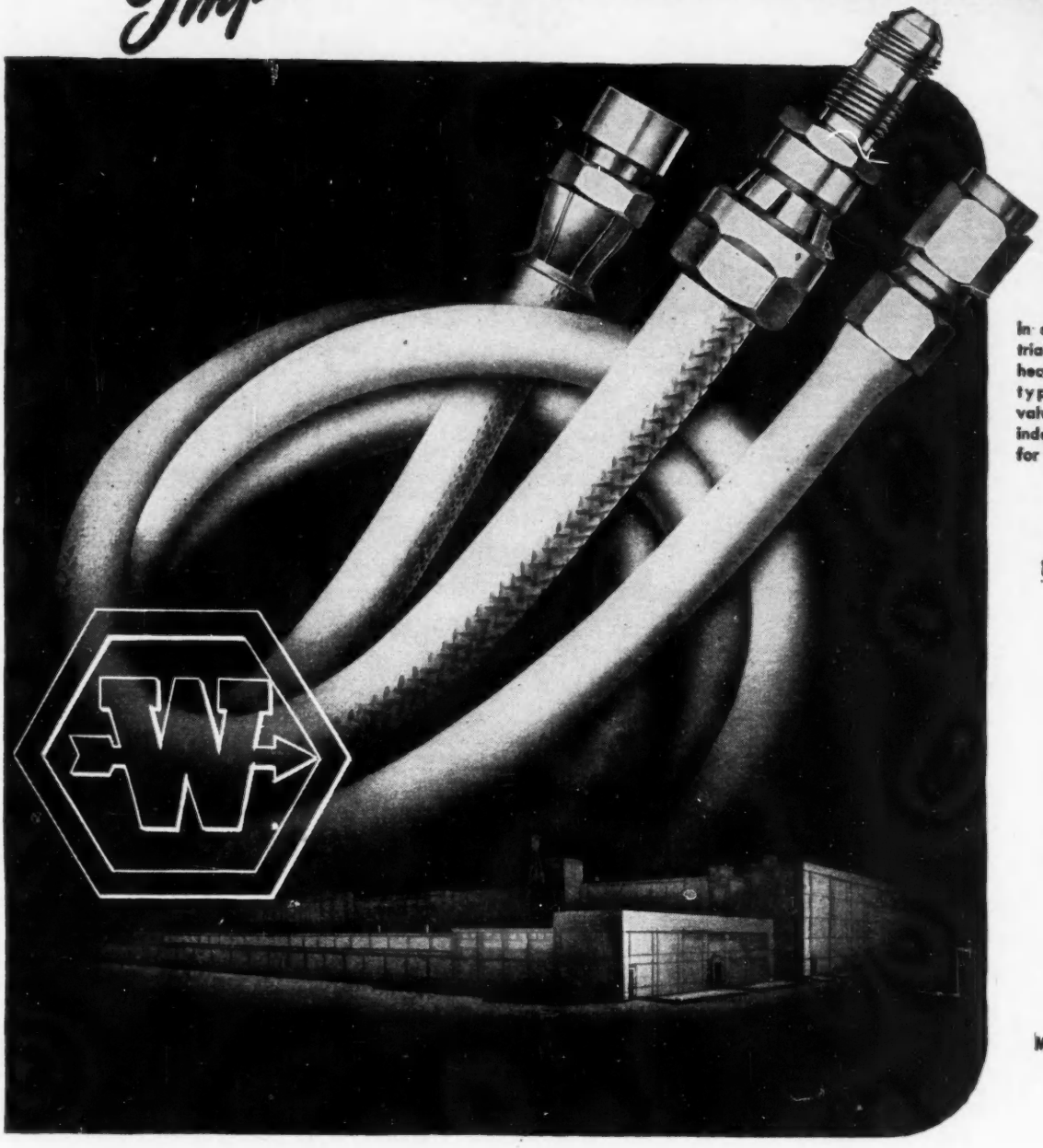
Improved INDUSTRIAL HOSE LINES



In addition to industrial hose, Weatherhead plants make all types of fittings, valves, hydraulic cylinders and other parts for these industries.

AUTOMOTIVE
★
REFRIGERATION
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RAILROAD
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MARINE
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FARM EQUIPMENT
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DIESEL
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Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND 8, OHIO
Plants: Cleveland, Columbia City, Ind., Los Angeles
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New uses are being found daily for the application of our *improved* industrial hose lines on machinery of all kinds. We manufacture hose assemblies of all types to withstand pressures up to 10,000 P.S.I. They can be equipped with either permanent crimped ends or with re-usable, quick-attachable hose ends. For information or literature write or phone any Weatherhead branch office.

BRANCH OFFICES: NEW YORK • PHILADELPHIA • DETROIT • CHICAGO • ST. LOUIS • LOS ANGELES

THE AQUA-TITE Simplex

.... a New and Advanced AUTOMATIC SHAFT SEAL

Developed to meet the demands for a perfect automatic shaft seal for all purposes. It has a rare combination of advantages in that it is extremely simple, costs less, saves machining and installation costs, and will do a better job of sealing through a longer life like all Aqua-Tite seals.

OUTSTANDING FEATURES...

★Comes as a single unit.

★One piece only to handle.

★One sealing surface only.

★Consequently—less spring pressure—less wear.

★No slots in pumps or impellers.

★Fool proof—only one way to assemble.

★Easy to install, easy to replace.

The sealing disc is made of a carbon alloy, a material recognized as superior for the purpose. It is securely bonded integrally to the rubber housing and thus eliminates the sealing disc as a separate piece and, consequently, one of the faces to seal. This reduces the usual functions of the spring to keeping only one set of surfaces in sealing contact. ... The materials used in the Simplex seal are the same so carefully selected and proven in millions of other Aqua-Tite seals. All metal parts are non-corrosive and the important spring is safely protected inside the seal.

★The life of a Simplex will be the life of the pump.

A COMPLETE WATER PUMP SERVICE—a fine seal—a fine impeller—or a complete pump for your new product or improving present models. Send us your inquiries. We have advantages in both performance and price.

CUTAWAY VIEW OF SIMPLEX SEAL AND SEAL INSTALLED IN AUTOMOTIVE WATER PUMP HOUSING

Note the utter simplicity of both pump housing and impeller—how core making and machining costs of pump are reduced.

PATENT APPLIED FOR)

SCHWITZER-CUMMINS COMPANY

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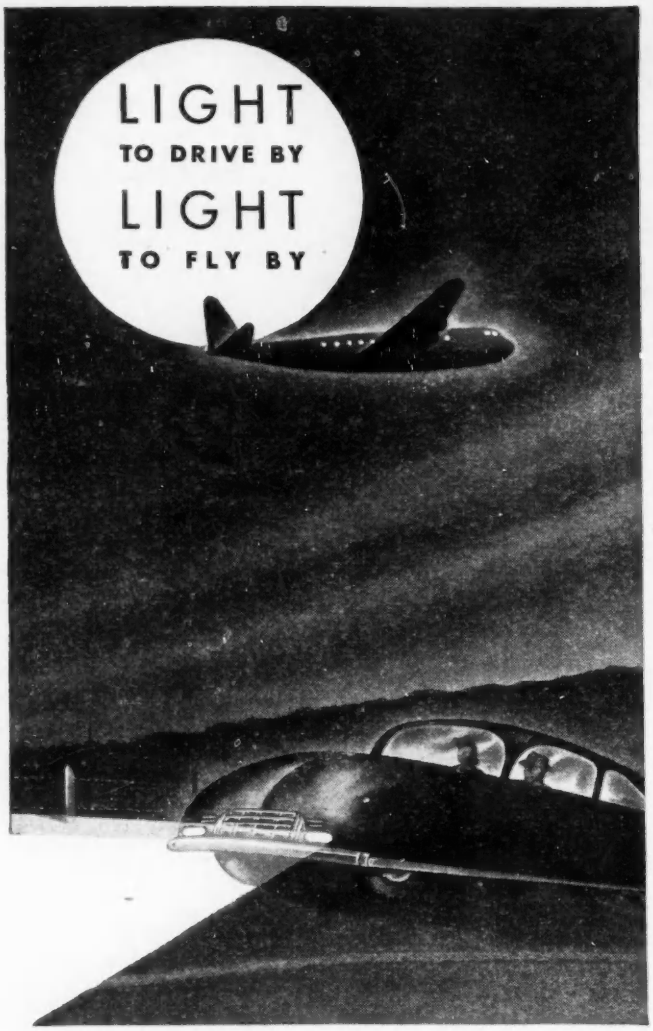
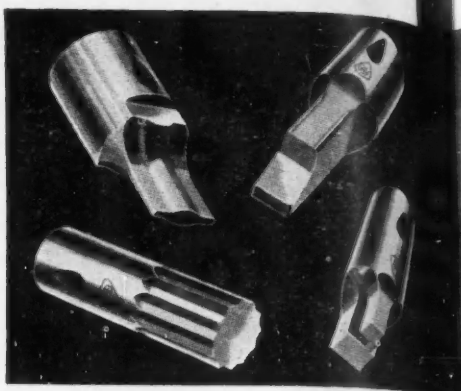


There is a sound reason why TUNG-SOL Lamps are an accepted standard for initial equipment and replacement in both the automotive and aviation industries. TUNG-SOL has proved its ability to manufacture dependable miniature incandescent lamps on a mass production basis. Today you find TUNG-SOL Lamps in cars, trucks, busses and planes throughout the world. Specify TUNG-SOL when ordering lamps and be sure of uniform high quality.

TUNG-SOL

MINIATURE LAMPS
and
ELECTRONIC TUBES

TUNG-SOL LAMP WORKS INC., NEWARK 4, N. J., Sales Offices: ATLANTA, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK, PHILADELPHIA. ALSO MANUFACTURERS OF CURRENT INTERMITTORS



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● Allied's R-B Interchangeable Punch and Die is "standard" in metal working and plastic industries. Standard shapes and sizes carried in stock. Illustrated are four of the thousands of special designed punches we have made. Special R-B punches and dies made in any material, shape and size desired. Send for large, illustrated R-B catalog, now.

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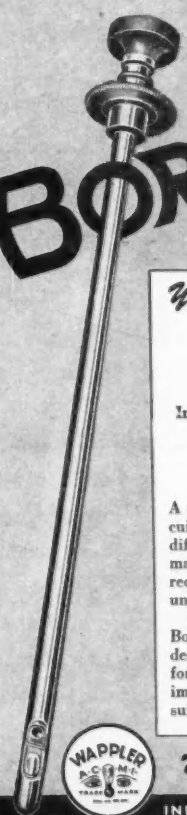
WAPPLER BORESCOPE



You can turn a hole Inside Out or See Around a Corner
with the
Wappler Industrial Telescope

Inspection Problems in the Examination of Internal Surfaces May Be Solved by Means of the WAPPLER BORESCOPE

A telescopic instrument containing a lighting circuit and a lens system. Various angles of vision for different types of visual systems are available. You may select the type best suited for your particular requirements, with the assurance that the resultant undistorted image will be clear and concise.

If you have an inspection problem, the Wappler Borescope will help solve it for you. An accurate description, blueprint, or better still, the part itself forwarded to our Industrial Division will have our immediate attention with recommendations for a suitable instrument to solve your problem.

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INDUSTRIAL DIVISION
AMERICAN CYSTOSCOPE MAKERS, INC.
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HOME for them!

and the HOME STRETCH for YOU!

You still have time! In December, your employees' allotments to the Victory Loan through your company's Payroll Savings Plan offer a final chance to help speed the proud homecoming of our fighting men—and do all in medical power for our hospitalized heroes!

Make December a plantwide TOP-THE-QUOTA drive! Now's the time to spotlight your Payroll Savings Plan—and "brief" your Bond-selling organization for fast, last minute action!

Resolicit every employee to buy the New F.D.R. Memorial $200 Bond

The new Franklin Delano Roosevelt $200 Bond—better than actual cash because it earns interest—is a strong building stone toward the secure future of every employee-purchaser!

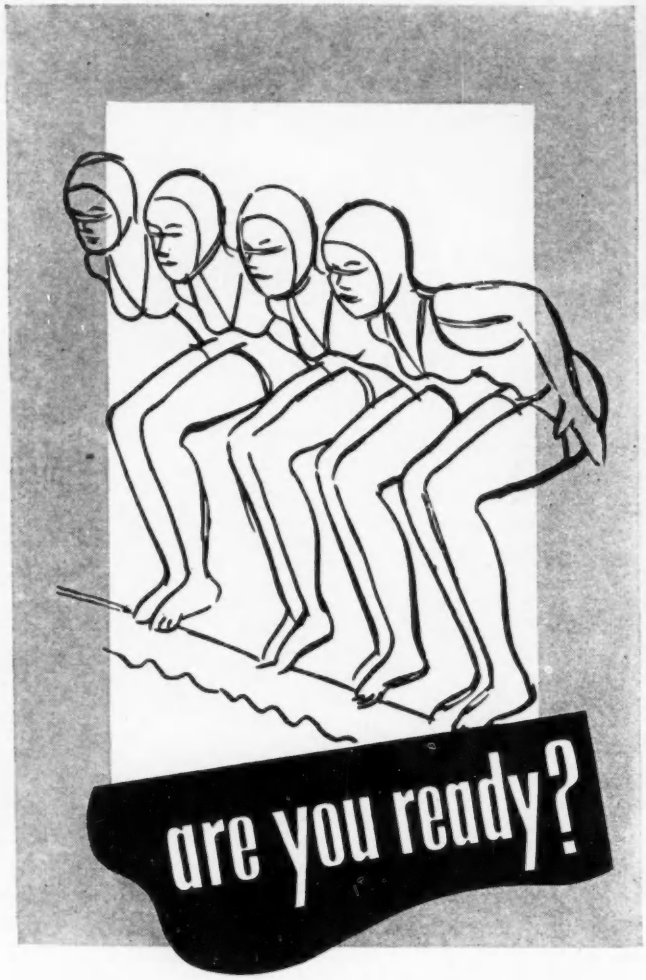
From now 'til the New Year—with plant rallies, interdepartmental contests and resolicitation—keep Payroll Savings Plan Bond-buying at a new Victory Loan high! Buying a Victory Bond is the best way of saying "Welcome Home" to our returning veterans! Also an active aid in assuring prosperity to your nation, your employees—and your own industry!

VICTORY LOAN

The Treasury Department acknowledges with appreciation the publication of this message by

SOCIETY OF AUTOMOTIVE ENGINEERS, INC.

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and War Advertising Council



There's a race on—for markets, against finely trained fast-stepping competition.

Are you ready?

Many alert manufacturers have talked over their problems—with Aetna; have found practical ways to improve both their products and their equipment by use of more bearings, or better suited bearings; are already in the pink of condition for a gruelling contest.

Aetna can help you plan right now; and faced by no reconversion problem, we can start making bearings for you as soon as our war production obligations, rapidly diminishing, have been finally discharged.

Better call Aetna. Aetna Ball and Roller Bearing Co., 4600 Schubert Avenue, Chicago 39, Illinois.

IN DETROIT:
SAM T. KELLER,
7300 Woodward Avenue,
Phone Madison 8840-1-2.

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Standard and Special . . .
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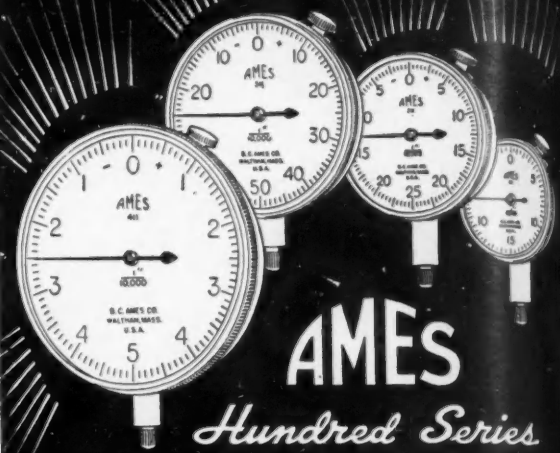
. . . Special,
BALL RETAINERS, HARDENED and GROUND WASHERS

Aetna BALL & ROLLER BEARINGS

4 Sizes ~ 14 Dial Faces



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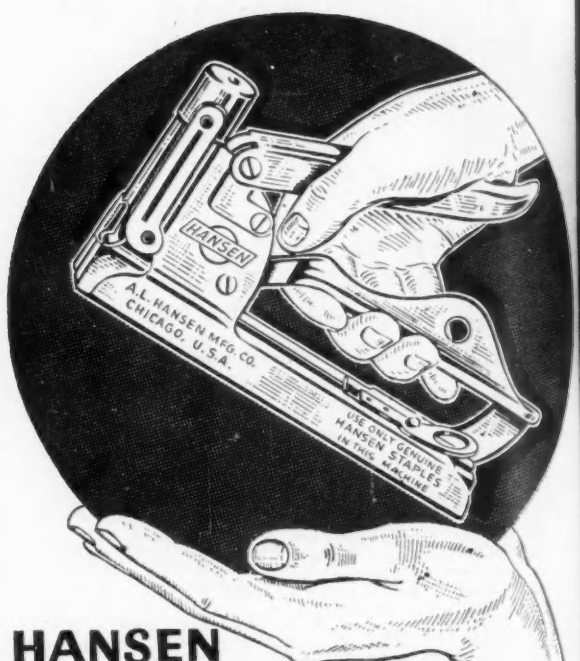
Hundred Series
DIAL INDICATORS

In four sizes with fourteen different dial graduations, indicating thousandths, half-thousandths or tenths of thousandths inches.

Speedy, accurate, inexpensive and adaptable to various measuring and testing jobs.

Write today for catalog.

B.C. AMES CO., WALTHAM, MASS.



HANSEN *one-hand* TACKERS

A Handful of Efficiency

FASTER tacking and fastening—without wasted effort, motion or materials—that's Hansen, the one-hand Tacker so extensively used in essential industry. Self-Contained Portable. One-hand operation. Drives Tack points or tacks up to ½" length.

REQUEST FOLDER

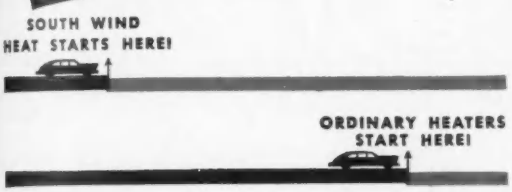
A. L. HANSEN MFG. CO.
5048 RAVENSWOOD AVE., CHICAGO 40, ILL.

HOT NEWS on faster Heating

1. Most Every-Day Car Trips Are UNDER FIVE MILES!

In fact, the average length of *all* trips is under five miles.* Driving to school is under 3 miles. Many other types of trips are equally short. Thus, every-day driving in winter calls for HOT HEAT FAST! Ordinary heaters can't provide heat fast enough.

**National Survey by Automobile Manufacturers Association.*



2. Only a South Wind Heater Can Provide "Short-Trip" Comfort

Waiting for engine heat to heat a car on short trips usually means reaching your destination before you're comfortable. Ordinary heaters just can't get riders out of the shivery "frigid zone" quick enough! A South Wind *creates* its own heat—in blocks instead of miles you enjoy plenty of healthful, living-room heat—*fast!*

3. "South Wind" Means World's FASTEST HOT HEAT!

. . . no wonder 1,250,000 car owners bought South Winds shortly before the war!

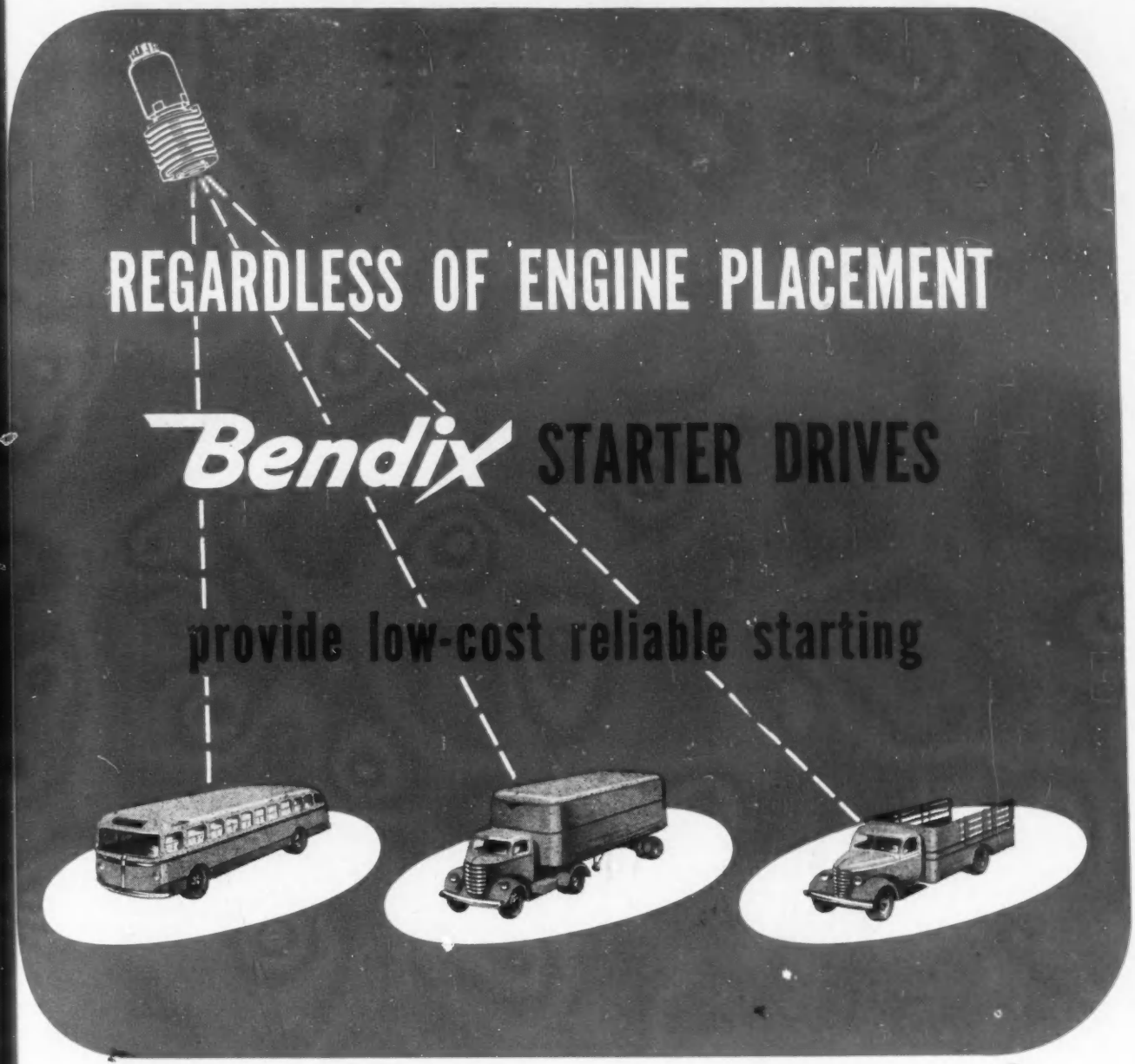
It's common knowledge that South Wind revolutionized car heating. It met the need *and demand* for hot heat fast . . . and only South Wind could provide it. From the very first day, South Wind was a sensation . . . became America's fastest selling quality car heater because it gave motorists what they wanted—HOT HEAT QUICK!

A new South Wind development has come out of the war. A bigger, better heater for trucks and busses. The scope of its applications is exceedingly broad . . . it does not depend on manifold vacuum, and can, if desired, operate independently of the engine. This special South Wind has new controls, delivers more heat—fast! It was developed for an entirely new market and is in no way competitive with the standard South Wind heater for passenger cars.

The chances are excellent this new South Wind is the answer to your heating problem. Why not talk it over? No obligation. Stewart-Warner Corporation, Indianapolis 7, Indiana. In Detroit, 3-140 General Motors Building.

South Wind REG. U. S. PAT. OFF. **CAR HEATERS**

Another Product of STEWART WARNER



If you are planning or producing commercial vehicles here is one important fact to keep in mind. The fully automatic operating principle of the Bendix* Starter Drive eliminates any need for specially designed mechanical linkage for each change in engine location.

For with the Bendix Starter System all that is required is a simple starter switch near the operator and a wire connection to the cranking motor.

The advantages of this complete adaptability of the Bendix Starter Drive are not only simplicity of design, and trouble-free operation. Of perhaps even greater importance to manufacturers is the fact that Bendix Drive provides the *least expensive* and the *smallest* unit for remote control instrument panel starting—as the solenoid is used only to close the electrical circuit.

The Bendix Starter Drive principle gives fully automatic meshing and demeshing, resulting in lower cost, simplicity of installation and complete safety to the starting system in case of accidental engagement while the engine is running.

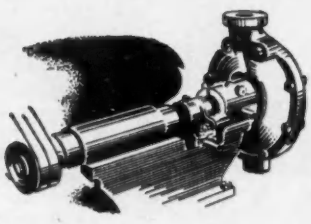
Bendix starter design and dependable performance have been proven by over sixty-five million installations. Bendix engineers will welcome an opportunity of working with you on your starter problems.

*REG. U. S. PAT. OFF.

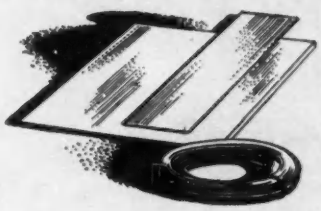
Bendix Drive ECLIPSE MACHINE DIVISION, ELMIRA, NEW YORK

For the Tough Jobs use H

Properties of HAYNES STELLITE Alloys	Average Tensile Strength, psi	Average Hardness, Rockwell	Melting Point, Deg. F	Can be Forged	Can be Rolled
HAYNES STELLITE Cobalt-Base Alloys					
1	47,000	C54	2,282	No	No
6 Cast	105,000	C40			
Rolled	130,000	C40 to C46	2,327	Yes	Yes
12	76,000	C48	2,306	No	No
Star J-Metal	65,000	C61	2,318	No	No
98M2	63,000	C62	2,250	No	No
HASTELLOY Nickel-Base Alloys					
B Cast	80,000	B96			
Rolled	135,000	B98	2,440	Yes	Yes
C Cast	76,000	B93			
Rolled	120,000	B90	2,350	No	Yes
D Cast	38,000	C53	2,040	No	No
HAYSTELLITE Tungsten-Base Alloys	—	Between 9 and 10 Moh's Scale	—	No	No
HASCROME Iron-Base Rod	40,000	C40-50 after peening	—	Yes	Yes



Castings . . . A wide range of castings can be supplied in:
HAYNES STELLITE Alloys 6, Star J-Metal, 98M2, 93
HASTELLOY Alloys B, C, D
HAYSTELLITE Tungsten-Base Alloys



Rolled Forms . . . Sheets and plates are made from:
HAYNES STELLITE Alloy 6
HASTELLOY Alloys B, C
Hot-rolled bars are supplied in:
HASTELLOY Alloy B

Welding Rods . . . for applying a wear- and corrosion-resistant alloy coating to other metals:
HAYNES STELLITE Alloys 1, 6, 12
HASTELLOY Alloys B, C, D
HAYSTELLITE Alloys
HASCROME Rod

HAYNES STELLITE Alloys

Resistance to Corrosion		
Oxidation at High Temp.	Sulphuric Acid	Hydrochloric Acid
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Fair	Good	Excellent
Excellent	Good	Good
Fair	Excellent	Fair
—	—	—
Fair	—	—

Available in a wide range of properties and forms to resist wear, corrosion, and heat . . .

HAYNES STELLITE alloys are specially made to meet the requirements of industry's most difficult applications. They are hard, tough, and heat-resistant and are used for those parts of equipment and machines that are most subject to wear and corrosion. The chart at the left describes some of these alloys and their significant properties. Sketched below are some of the forms in which they can be furnished.

For further information, write for the booklet, "Properties of HAYNES STELLITE Alloys."

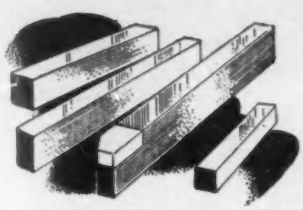
HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Office and Works, Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa



Metal-Cutting Tools . . . made from HAYNES STELLITE Alloys, known for their red hardness. These tools take heavy cuts at high speeds and coarse feeds—with long life between grinds:

HAYNES STELLITE Star J-Metal
HAYNES STELLITE Alloy 98M2

HAYNES STELLITE TRADE-MARK

HAYNES STELLITE . . . HASTELLOY . . . HAYSTELLITE . . . HASCROME are registered trade-marks of Haynes Stellite Company.

BUY AND HOLD UNITED STATES VICTORY BONDS AND STAMPS

What new "armor" for steel can save America millions each year?

YEAR AFTER YEAR—in war or peace—America pays a colossal toll in dollars to a foe as unrelenting as any ever known.

It is the enemy *rust*, that attacks and destroys things made of steel. But now a remarkable new discovery can bring you steel products that will *defy* rust up to 4 times longer . . . Hardware, screens, fencing, automobiles, tractors, dozens of important items that will outlast any you've ever owned by as much as 4 to 1!

This remarkable discovery is CORRONIZING, the patented alloy "armor" that gives steel a new lease on life. Yes, CORRONIZING is new . . . but also thoroughly tested and proved. For CORRONIZING has demonstrated its overwhelming superiority in the war, under the worst possible conditions on land, at sea and in the air.

By test and performance, CORRONIZING FAR OUTLASTS OTHER PROTECTIVE COATINGS FOR STEEL. Now, the more progressive factories and retailers will be able to bring you products made of "Corronized" steel. Motor car makers—always leaders—will be among the first to offer you this sensational advantage.

Remember that name—CORRONIZING. It can save you and millions of other Americans a huge tax bill now needlessly paid to the enemy rust.

Standard Steel Spring Co.

ORIGINATORS OF

CORRONIZING

The Magic Carpet to Longer Life for Steel

Quick Facts for Manufacturing and Sales Executives

Do not confuse CORRONIZING with other metal coatings. This patented process provides a permanent alloy "armor" with 5 layers of defense against corrosion! It becomes part of the steel base . . . can be worked in any manner. Permits using lighter materials by prolonging steel's period of greatest strength. Write for samples and complete information.

STANDARD STEEL SPRING COMPANY
CORAOPOLIS, PENNSYLVANIA

ELECTRICAL ENGINEER DESIGN EXPERIENCE

NOW AND POST-WAR

We manufacture special control equipment involving mechanical and electrical components.

An opening exists in our organization for several additional engineers who have had design experience. Opportunity exists for the individual engineer to carry a development from the initial stage of design to preliminary production.

The applicant should possess a basic engineering training and experience. In applying give full experience, present salary and salary expected. A photograph is desirable.

We welcome the opportunity to discuss these openings with individuals interested in a permanent connection with a progressive organization.

Box 144, S. A. E. Journal
29 West 39th St., New York 18, N. Y.

DRAFTSMEN

Large steel company in Pittsburgh area has several opportunities for draftsmen with high school or college education and experience in the following areas: design of steel mill and steel foundry products; railroad track accessories; layout and design of steel mills, blast furnaces, open hearth furnaces, and power plants; design of fabricated concrete bars; layout of electric power and control equipment; general mechanical design and layout. Please submit details, statement of experience and education, inexpensive photograph, and required minimum earnings.

Write Box 128, S.A.E. JOURNAL
29 West 39th St., New York, N. Y.

S.A.E. MEMBER *available in* LONDON

to act as full time representative for U. S. firm considering exporting to England, or Continent, automobiles, trucks, tools, accessories, etc. Present position Engineer and Transport Manager fleet of 100 heavy dump trucks: (free November) prior to that with Ford and General Motors organizations: five years U.S.A.). British nationality. Age 42. Particular experience organization Service and Parts.

Write Box 149, S.A.E. JOURNAL
29 West 39th St., New York 18, N. Y.

Only Two-Way Hydraulic Power

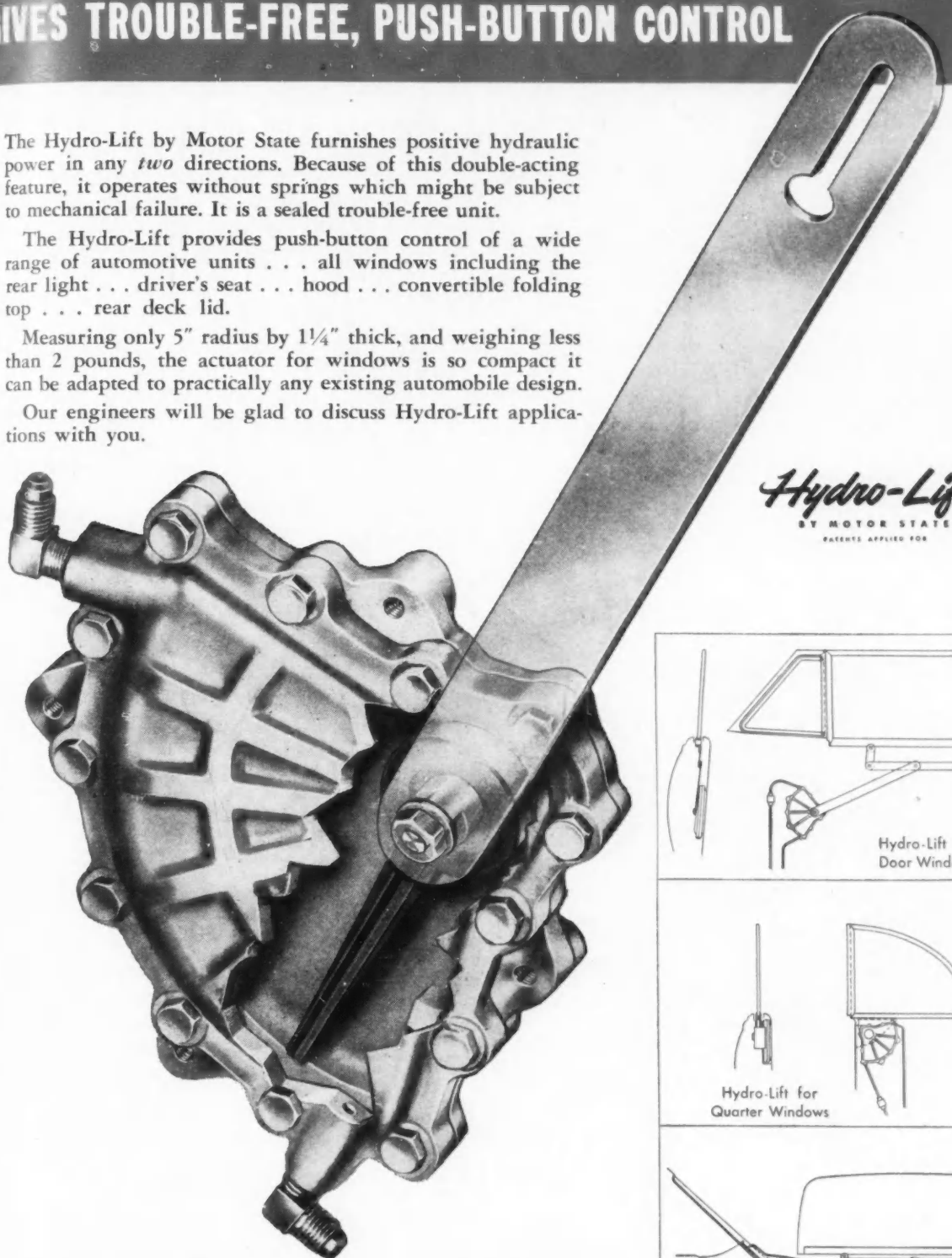
GIVES TROUBLE-FREE, PUSH-BUTTON CONTROL

The Hydro-Lift by Motor State furnishes positive hydraulic power in any *two* directions. Because of this double-acting feature, it operates without springs which might be subject to mechanical failure. It is a sealed trouble-free unit.

The Hydro-Lift provides push-button control of a wide range of automotive units . . . all windows including the rear light . . . driver's seat . . . hood . . . convertible folding top . . . rear deck lid.

Measuring only 5" radius by 1¼" thick, and weighing less than 2 pounds, the actuator for windows is so compact it can be adapted to practically any existing automobile design.

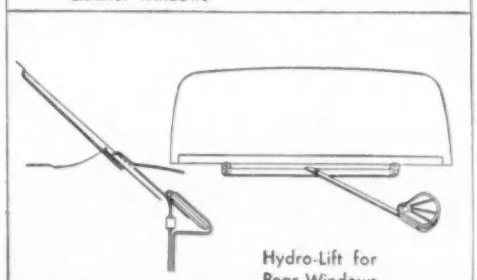
Our engineers will be glad to discuss Hydro-Lift applications with you.



Hydro-Lift
BY MOTOR STATE
PATENTS APPLIED FOR

Hydro-Lift for Door Windows

Hydro-Lift for Quarter Windows



Hydro-Lift for Rear Windows

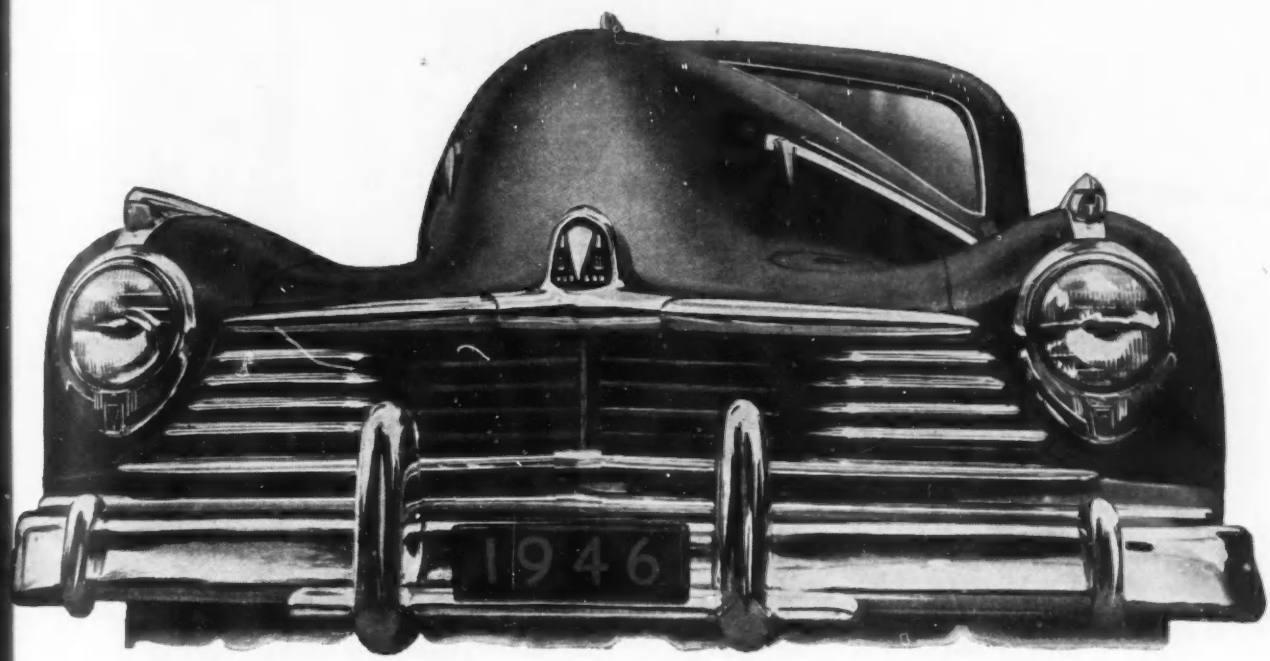
MOTOR STATE PRODUCTS COMPANY

General Offices and Plant: Ypsilanti, Michigan • Detroit Office: 2-257 General Motors Building

ORIGINATORS OF THE AUTOMATIC PUSH-BUTTON TOP

INDEX TO ADVERTISERS

The 1946 HUDSON



Spicer Equipped as always!

Spicer universal joints have been standard equipment in Hudson motor cars since they first were built in 1909. This 27 year record of dependable Spicer service will continue in the sleek new 1946 Hudson automobiles now leaving the assembly lines. And each new Hudson on the road will add greater prestige to Spicer engineering and manufacturing skill . . . for 42 years the standard of excellence in the automotive power transmission field.

Spicer Manufacturing Corporation, Toledo 1, Ohio

The new **1946 HUDSONS** **are equipped with Spicer Universal Joints and Propeller Shafts.**

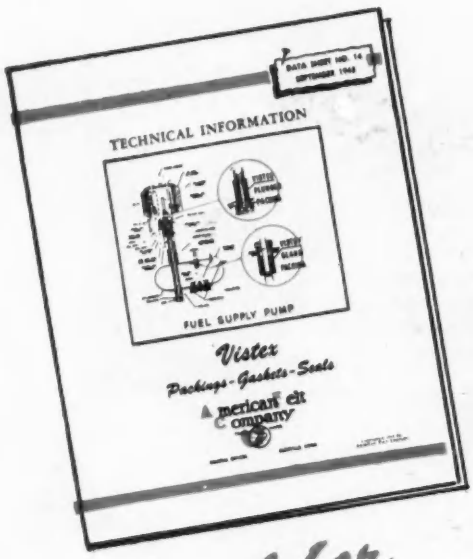
42 YEARS OF Spicer SERVICE

Now Available ... after vigorous war testing

VISTEX

a positive sealing and self-lubricating element

... for packing washer or heavy duty bearing seal application



Send for

Data Sheet No. 14.

Vistex is a sheet laminated, felt base material engineered to meet the performance requirements of automotive and military hydraulic shock and shimmy dampener packings. Constructed of multiple ply thicknesses of synthetic or natural rubber impregnated felt, and available in four standard types, Vistex is suited to a broad range of operating conditions. High operating and maintenance efficiency are assured without premature failure from overheating, accelerated aging, decomposition or dimensional distortion in maintenance reassembly.

Write for samples and Data Sheet No. 14, "Vistex Packings – Gaskets – Seals".

FOR YOUR FILES

Other American Felt Company Data Sheets are listed below. Check and write for those which you need to complete your Felt reference file.

1. Felt Density and Hardness
3. "K" Felt — Sound Absorption and Thermal Insulation
5. S.A.E. Specifications — American Felt Company Qualities
7. A.S.T.M. Methods of Test for Wool Felt, D 461
8. U. S. Army Spec. No. 8-15G
10. Vibration Isolation with Felt
11. Annular Designing and Dimensioning
12. Flame-proofed Felt
13. Felt in Compression
14. Vistex Packings — Gaskets — Seals

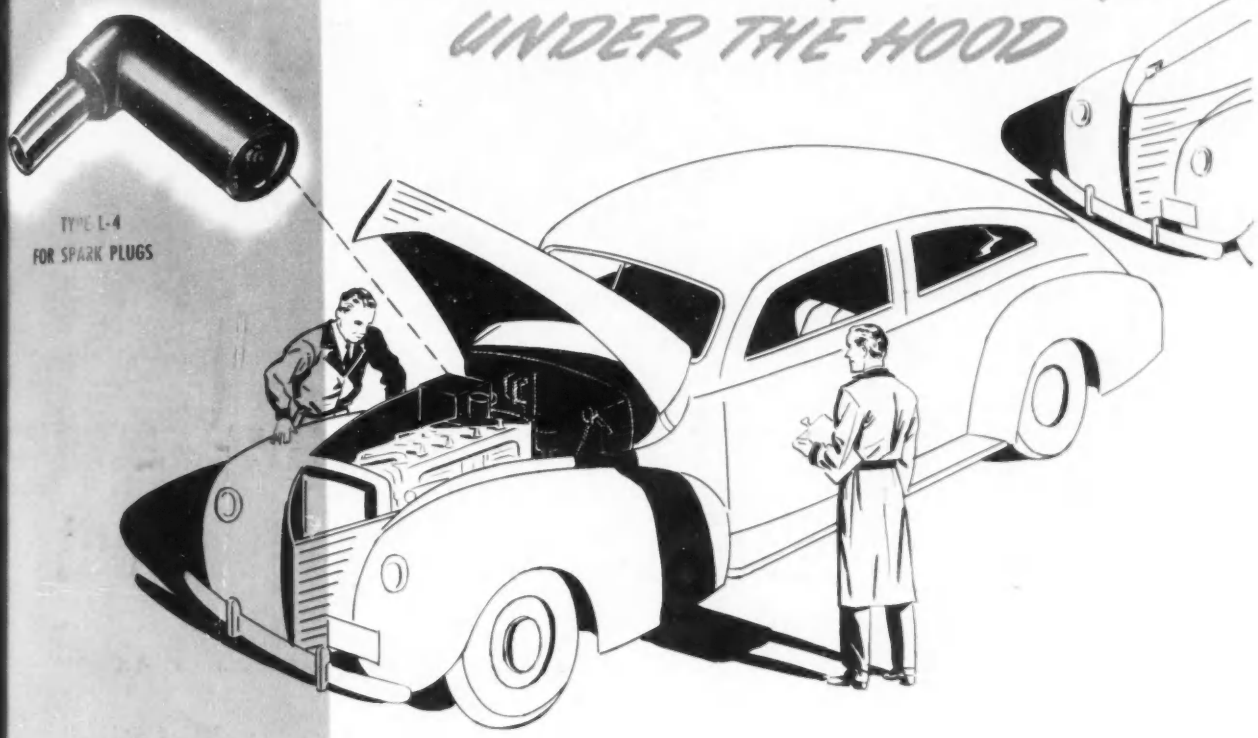
AmericanFelt Company

TRADE MARK

General Offices: GLENVILLE, CONN.

New York; Boston; Chicago; Detroit; Philadelphia; Cleveland; Dallas; St. Louis; Atlanta; Los Angeles; San Francisco; Seattle; Portland.

There's something missing
UNDER THE HOOD



TYPE L-4
FOR SPARK PLUGS

TYPE L-7
FOR SPARK PLUGS
AND DISTRIBUTORS

TYPE S-5
FOR DISTRIBUTORS

TYPE D-7 FOR
DISTRIBUTORS

Unless ERIE SUPPRESSORS *for Elimination of Ignition Interference in Radio Reception* have been installed

The first ERIE SUPPRESSORS were designed and used on many pre-war cars for the elimination of high frequency ignition interference in automobile radios. The immense advance in communication systems accelerated by the war thoroughly demonstrated two things; 1) Suppressors were a necessary part of all gasoline powered equipment, not only for eliminating interference with its own radio reception, but to prevent interference with neighboring High Frequency and F.M. receiving sets. 2) ERIE SUPPRESSORS eliminated interference without reduction of engine performance, and were able to stand up under all the punishment they got.

As we move into the age of F.M. and television receiving sets, war problems are duplicated at home. Wise manufacturers will win public favor by including ERIE SUPPRESSORS as standard equipment on all gasoline engines, mobile or stationary. Write today, on your company letterhead, for Data Sheet giving complete information on ERIE SUPPRESSORS.

Electronics Division
ERIE RESISTOR CORP.
ERIE, PENNSYLVANIA
LONDON, ENGLAND . . . TORONTO, CANADA

BUY
VICTORY
BONDS

YOU HAVE YOUR CHOICE...

...of Sizes from ½" to 10½" O.D. When You Buy TIMKEN Seamless Steel Tubing

If you make hollow cylindrical parts from ½" to 10½" O.D. take advantage of the benefits offered by Timken Seamless Steel Tubing. This tubing is made in this size range in light, medium and heavy walls.

The wide choice of sizes plus the fact that Timken Seamless Steel Tubing is made in carbon, alloy and stainless steels makes it possible for it to be applied economically to hundreds of applications.

Because it eliminates drilling, reduces boring, saves scrap and permits faster machining speeds, hollow cylindrical parts can be made faster and at less cost than when made from bar stock.

But you get more than just increased production when you use Timken Seamless Steel Tubing. You also improve the quality of the parts you make because this fine material is under the careful scrutiny of one organization that melts the steel - - rolls the billets and pierces the tubing.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
SEAMLESS STEEL TUBES

You can make good products better and faster by using Timken Seamless Steel Tubing. A member of our technical organization will be glad to recommend the proper size, grade and type for your particular application. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.